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NATURAL HISTORY

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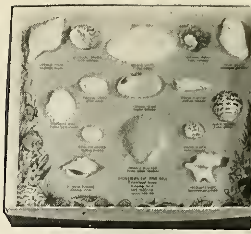

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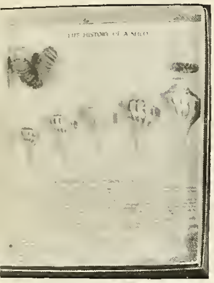

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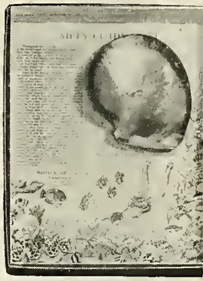

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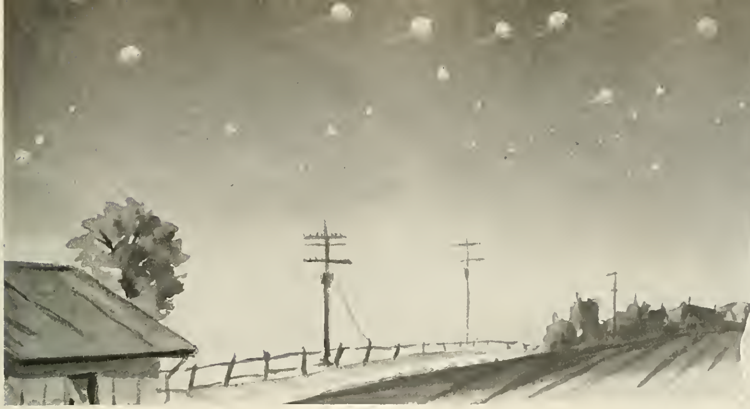
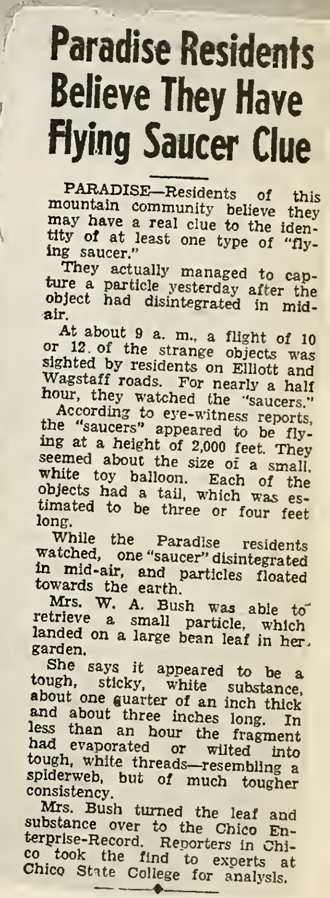


Those Things
in the sky

A spectacular display of "flying saucers"—
and the equally astonishing explanation

By W. H. HUTCHINSON



Paradise Residents Believe They Have Flying Saucer Clue

PARADISE—Residents of this mountain community believe they may have a real clue to the identity of at least one type of "flying saucer."

They actually managed to capture a particle yesterday after the object had disintegrated in mid-air.

At about 9 a. m., a flight of 10 or 12 of the strange objects was sighted by residents on Elliott and Wagstaff roads. For nearly a half hour, they watched the "saucers."

According to eye-witness reports, the "saucers" appeared to be flying at a height of 2,000 feet. They seemed about the size of a small, white toy balloon. Each of the objects had a tail, which was estimated to be three or four feet long.

While the Paradise residents watched, one "saucer" disintegrated in mid-air, and particles floated towards the earth.

Mrs. W. A. Bush was able to retrieve a small particle, which landed on a large bean leaf in her garden.

She says it appeared to be a tough, sticky, white substance, about one quarter of an inch thick and about three inches long. In less than an hour the fragment had evaporated or wilted into tough, white threads—resembling a spiderweb, but of much tougher consistency.

Mrs. Bush turned the leaf and substance over to the Chico Enterprise-Record. Reporters in Chico took the find to experts at Chico State College for analysis.

◆

WE live in the Sierra Nevada foothills of California, in the Cohasset district of Butte County, at an elevation of 2900 feet according to the topographic map of our quadrangle. We are twenty miles from the nearest Sacramento Valley town, our nearest neighbor is two and a half miles away, and we have no telephones, thank God! We are even farther removed, or so we thought, from the current uneasiness about interplanetary discs, sixteen-inch men from the Outer Galaxies, and atomic strikes by enemies of the United Nations. I think that my wife and I are people of intelligence and good reason. Our two boys, aged five and six plus, go to school at home via the Calvert course and are perfectly normal little hellions with 160 second-growth acres for their domain. This background seems essential to an appraisal of our recent visitation from the skies.

At 10:40 in the morning of October 11, 1950, Bee-Boy, the younger, came pelting into the house and up the stairs to my study with tears streaming down his face and fear sobs choking in his throat. The sky was filled with strange white objects that did not come down, that made no sound, and that went overhead too high and too fast for him to comprehend. It was the lack of sound, of the reassurance brought by noise, that seemed to matter most. He was so obviously panicky that I left my work and went with him to see these things, cursing every radio program, funny paper, comic book, and careless conversationalist that had ever entered our house. My wife, red-headed and competent, had already joined Jamey in the field that runs up behind our house, to the dense second-growth red fir, ponderosa pine, and incense cedar that rings our clearing. She had already seen the *Things,* and so did I as soon as I got the sun behind me.

At all elevations, from 100 feet above us to the blue empyrean, literally hundreds of shining silvery-white balls were speeding in a general northerly direction. Before our eyes, they divided and formed connected V's of two, three, and more globular objects that kept on their previous course. They could disintegrate or otherwise disappear before our eyes without a sound, seemingly with a trace of light blue smoke or vapor lingering for a moment to mark their end. One did come down almost to ground level, and as we ran to catch it, it suddenly spurted up above the treetops and disappeared as though some radar-like antenna had warned it of disaster. Other than the directional undulations of their long tails, the objects seemed solid and about

◂ WHAT was left when one of the *Things* hit a tree (about actual size)

the diameter of a dinner plate. They also seemed to have a common directional pattern and a happy faculty for evasive action.

The day was golden clear. There was not a cloud in the sky, and a strong fresh breeze was blowing from the south, a customary direction under normal barometric pressures in our locality. The day was warm, even for California in October, and the local press was referring to the "unseasonal" heat wave. The foothill oaks and bearberry and dogwood were turning color in the woods around us. God was in His Heaven, and all seemed right with our world; and there was undoubtedly a rational explanation for what we were seeing. But I am quite sure that I know now exactly how *Homo Heidelbergensis* regarded the Unknown beyond the fireshine at the cave mouth.

My wife advanced the hopeful theory that they were ash particles from a brush fire we knew was burning away off down the ridges to the south. This was a comforting thought, since a forest fire is a known quantity, but ash never travels hooked together in formation. Neither does ash survive long mileage in particles as large as these refulgent objects. Two planes had passed over just before the boys spotted the first of these white flyers, and they were willing to settle for parachutes, now that their parents were sharing their experience. Their parents thought perversely of balloons that could travel from across the Pacific with a deadly cargo. Vagrant weather balloons, jettisoned ping-pong balls from a onetime transoceanic plane, and anything else suitable to explain what we could not explain was considered and discarded.

We spent an hour observing our space travelers without reaching a solution as to their identity. Whatever they were, there were lots of them. We came indoors for luncheon, and the traffic had slacked off by the time we went outside for another look. By evening, they were not in evidence. We had spotted no forest fires near by; if radiation was going on, we did not feel it, and if little men were creeping up on us through the brush, our dogs could not detect them. We could not explain the phenomenon and locked our minds against that fact in self-defense.

Next morning, a mass of sticky, gauzy stuff was caught in a fir tree near the house. My simple mind recalled a recent book review covering the order Araneida, in which it said that certain spiders are known to climb upon a stump or large rock or whatever, weave a sail, and hop off bent on migration, thermally assisted. As far as I am concerned, that is the explanation of our visitation. In this day and age, a little knowledge of natural history can be comforting. I only hope it does not lull me into a false security. From now on, silvery objects in the foothill sky are transient spiders.

In an envelope accompanying this material I am sending the gauzy stuff that was collected in the evergreen tree. Perhaps the scientists at the American Museum of Natural History can analyze it and tell us what it is.

* * *

Dr. Willis J. Gertsch of the Museum's Department of Insects and Spiders reports as follows: "The material is, as Mr. Hutchinson deduced, spider threads, otherwise known as gossamer. Great showers of gossamer have fallen in many places in the world, and fantastic interpretations have been given in the effort to explain this. The true explanation is quite simple.

"Soon after hatching many spiders have the inclination to climb upward toward the sun and to throw silken threads out upon the soft breezes. This urge toward ballooning is surely one of the most extraordinary accomplishments of the spider. Once the spiderling has reached the highest point, it turns its face toward the wind, extends its legs to their fullest, and tilts its abdomen upward. The threads of spider silk are drawn out by the air current, and when the pull on them is sufficiently strong to support the weight of the spider, it lets go and is pulled into the air. It is presumed that some of the spiders actually exercise some control over their flight by pulling in, winding up, or streaming out more filaments.

"Individuals have been known to travel as much as 200 miles in this way without coming to rest. Flying is not solely the province of the baby spider, for spiders of all age groups, limited solely by size, indulge in the sport over much of the year. However, during the autumn months in temperate areas spiders become very active, and, either in unsuccessful attempts to balloon or for other purposes, they cover the meadows and shrubbery with innumerable threads, which soon form a thin webbing over everything.

"The Yosemite Valley in California is famous for its occasional dense accumulations of gossamer, and Mr. Hutchinson's home may be in a similarly favored area. In Yosemite, the shrubs, bushes, and trees are said to become so webbed that the trunks of the largest trees are but faint shadows, while limbs and foliage resemble a glistening mass of crystal. A sudden wind is able to dislodge portions of the material and to carry it into the air. Mr. Hutchinson and his family must have seen an unusually fine display of air-borne spider silk. The same explanation no doubt applies to the 'flying saucers' mentioned in the accompanying newspaper clipping from the Chico (California) *Enterprise-Record*, apparently reporting the same event."

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—NO. 1
JANUARY, 1951

Grand Canyon..........Cover Design
From a color photograph by Jack Breed

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Exploring underwater gardens of coral, capturing rare and beautiful fishes, and visiting natives who had never seen a white woman

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Feather Falls ....Philip Ferry 20
This spectacular cascade swings open the gates to one of northern California's least exploited wonderlands

With Audubon in the Florida Keys......Lucy Salamanca 24
A little-known interlude that marked a dramatic turning point in the career of John J. Audubon

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An ancient stream in Virginia shares its majestic handiwork with a modern railroad

The Descent into the Barranca del Cobre (Part II)
Robert Thomas Moore 34
Concluding actions in a thrilling story of how a band of scientists threaded their way over trails known only to Tarahumare Indians to reach this canyon

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One of the prettiest sights in this fairyland of lakes and mountains is a tiny bird with a long trailing tail

The Incredible Chameleon........Lewis W. Walker and G. E. Kirkpatrick 42
The only creature that can capture its prey more than a body-length away, by moving only its tongue

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It looks like a fruit tree but acts like a fence

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THE COVER THIS MONTH

The Grand Canyon of the Colorado, featured on this month's cover, provides a thrilling and colorful view from whatever point you see it. This particular scene was photographed by Jack Breed at Point Imperial on the North Rim, looking down into Nankoweap Basin in the eastern end of Grand Canyon National Park.

The jagged pinnacle in the center foreground is named Hayden Butte or Hayden Mountain in honor of Charles T. Hayden, an early pioneer in Arizona, who arrived in 1857 on the first overland stage to reach Tucson. The butte towers 5639 feet above the Colorado River at this point and rises a total of 8350 feet above sea level.

Grand Canyon National Park, established by Act of Congress in 1919, contains 1008 square miles and includes 56 miles of the Canyon's 280-mile length. The gorge varies in width from four to eighteen miles, and its depth is over a mile in many places. Covering the North Rim, where this picture was taken, is the beautiful Kaibab Forest, which helps to accent one of America's most sublime spectacles.

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THE REPTILES AND AMPHIBIANS OF SOUTHERN AFRICA

- - - - - - - - - - by Walter Rose

Maskew Miller, Ltd., Cape Town, 30/
378 pp., 214 photos

PRESUMABLY it was some time in the early '20's that Dr. Walter Rose, a South African dental surgeon, embarked upon his hobby. Accompanied by his three sons, he devoted week-end outings to studies of the frogs, lizards, snakes, and tortoises inhabiting the vicinity of Cape Town. Little was known of the habits or life histories of many animals in this interesting region, a situation that Dr. Rose set out to remedy.

By 1929, he had assembled enough information, sketches, and photographs to prepare *Veld and Vlei,* a book that contained a wealth of information gleaned from various sources, much of it based upon personal observation. Unfortunately, a fire at the publisher's establishment destroyed the bulk of the edition before many copies found their way to America.

Meanwhile, Dr. Rose continued his studies with unflagging interest. Gradually this expanded into a desire to produce a reasonably complete account of the amphibians and reptiles of southern Africa. The result is an enlarged and thoroughly readable description of an extraordinary fauna, which includes a frog that sometimes lays its eggs in damp earth, a tortoise that lays several times a season but deposits a single egg at a time, cobras with modified fangs that permit them to eject their venom into the eyes of the enemy, and a chameleon that is a poor climber and spends most of its time on the ground!

Dr. Rose has made a valiant effort to bring all scientific names up to date, a difficult feat with the nomenclature in a state of constant flux. Readers acquainted with the problem will pardon his inability to keep fully abreast of the changes systematists have indicated. Less pardonable are such misspellings as "axolytol" for "axolotl" and his confusion concerning the families of snakes. Such mistakes do not seriously mar the book, and American naturalists will find much of value and interest in the descriptions of unusual habits or life histories. Personal anecdotes and philosophical digressions, sometimes humorous or satirical, sometimes whimsical or even naïve, add to the charm of this unique book, by a man who has made the most of his hobby.

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FISHING IN MANY WATERS

- - - - - - - - - by James Hornell

Cambridge University Press
London and New York, $6.00
204 pp., 44 figs., 36 plates

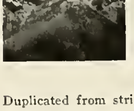
THIS is a fascinating book, even to one who does not particularly care for fishing. The author has drawn on his long experience as technical expert on Fisheries for the Colonial Office of the British Government to give vivid descriptions of the varied fishing methods practiced in Africa, the Mediterranean, India, Ceylon, China, Japan, Melanesia, and Polynesia. He has observed most of the practices at firsthand, and the descriptions are vivid and entertaining to the general reader, as well as filled with the sort of detailed description that is so much valued by the ethnographer.

The volume is organized according to fishing techniques and industries, but the author has not hesitated to insert full chapters on subjects that have interested him particularly and on the methods of specific ethnic groups.

Two mild criticisms of this volume occur to me. Specialists who will want to make use of the wealth of detail will find the lack of a more formal organization a trifle disconcerting. This is explained by the fact that the volume has not been written for the specialist, and there is partial compensation in the index. The second criticism refers to the assumption, which the author makes in several places, that the simpler types of fishing gear necessarily preceded the more complicated devices. This is unwarranted, for history cannot be deduced from typological comparison alone.

Fishing in Many Waters is well written in an easy narrative style, and text figures clarify many of the descriptions. The 36 plates placed at the back of the volume are excellent.

JAMES A. FORD



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THE PLANET MARS

- - - - - by Gerard de Vaucouleurs
Translated by Patrick A. Moore

Macmillan Co., $2.00
87 pp., 5 plates, 5 figs.

FOR many years, men from Mars have been stock characters in science-fiction writings and in the comics. Now that we are entering the interplanetary age, interest in other worlds than ours has increased immeasurably, and M. de Vaucouleurs' excellent little book will be well received by laymen as well as scientists. Such intriguing questions as the possibil-

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ity of life on Mars, the truth about the Martian "canals" (are they proof of the industrious activity of the Martians, or are they nothing more than persistent optical illusions?), the physical conditions on Mars, and the possible explanations of the changes on the planet's surface as observed from the earth are discussed. The reviewer noted only several minor inaccuracies in the book; and until a larger volume is published, this excellent little book, bringing together concisely all that is now known about the planet Mars, will hold supremacy in the field.

Kenneth Heuer

INDIAN ART OF THE AMERICAS

- - - - - - by Le Roy H. Appleton

Charles Scribner's Sons, $15.00
279 pp., 79 color plates

AFTER the many excellent books that have appeared recently in the field of American Indian art, Mr. Appleton's contribution is a distinct disappointment. In attempting to deal with the art styles of the entire Western Hemisphere, the author fails to give an adequate portrayal of the artistic tradition of any particular area or group. The various tribes of both continents are grouped arbitrarily into seven geographical areas that correspond neither to art styles nor to types of culture, and this meaningless organization results in an inaccurate and highly misleading juxtaposition of objects in the illustrations. Mr. Appleton is equally cavalier about time, and jumbles pre-Columbian and contemporary materials in a most confusing manner.

No systematic attempt has been made to relate the various examples of American Indian art to their proper cultural contexts. Instead the author has included a miscellaneous (and nonrepresentative) assortment of myths and tales on the highly dubious premise that these legendary scraps will disclose what the Indian artists intended their creations to mean. The brief introductory notes abound in loose generalizations and include not a few shocking errors of fact. We are told, for example, that the principal migration route from Asia to the New World was across the Aleutian Islands, and that "Indian languages were not equipped to employ abstract terms . . ." In addition, Mr. Appleton consistently uses obsolete anthropological designations — "Cliff-Dweller," "Mound-Builder," and the like—that ceased to be respectable a half century ago.

The plates themselves are crowded and unattractive, and the color values are so inaccurate that the illustrations bear little resemblance to the original objects. Since color is as important to design as form, line, or composition, the plates will be of no more use to art students than they are to anthropologists.

Harry Tschopik, Jr.

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FIELD BOOK OF SEASHORE LIFE

- - - - - - - by Roy Waldo Miner

G. P. Putnam's Sons, $6.00
888 pp., 250 black-and-white plates,
24 in full color

NO general manual of the marine invertebrate animals of our Atlantic coast has been published for a great many years. Such a book must deal with most of the marine animals except the true fishes, and the difficulty of the task and the many illustrations required have deterred both authors and publishers from attempting it.

The present book aims to provide such a manual, adapted not only for beginners and amateurs who would be discouraged by too much technical matter but also for more advanced students, teachers, and scientific workers, and for others who want a handy work of reference. These requirements are often directly conflicting, but the book fulfills them with far more success and less compromise than would be thought possible.

This has been accomplished largely by the abundant and excellent illustrations. All of the 1300 species dealt with have at least a small cut to show distinguishing characters and often also a figure on one of the many colored plates. The illustrations are line drawings, not photographic reproductions, which are apt to be obscure on the most important points. Specimens can often be identified simply by looking through the illustrations. In the text the use of technical terms has been kept to a minimum, though of course it cannot always be avoided in a book dealing with animals most of which have no names other than their scientific or so-called "Latin" ones. But the technical terms unavoidably employed are usually understandable or are sufficiently explained by the text and illustrations.

The preliminary paragraphs, or in some cases pages, by which the descriptive matter on the various groups is headed, explaining their chief characters, external and internal, habits, etc., deserve special commendation. They contain a great deal of information and immensely increase the value of the book.

Such a work requires many years of labor to prepare and must necessarily be in many parts a compilation from other works. On many of the groups of animals very little has been published in recent years and many things, among them the frequent changes in scientific names, make it impossible to make every page equally satisfactory and up to date. But such books are indispensable for the progress of science, and their authors deserve the thanks of those who use them rather than criticism for the occasional small errors, omissions, or minor defects that in spite of all care slip into every comprehensive work. As such works go, this is an unusually complete, well-arranged, and reliable book. It will soon earn its price in saving time-consuming research, and it will be one of the most frequently consulted works in the libraries of high schools, colleges, and other educational institutions.

Willard G. Van Name

Flies

- - - - - - - - by J. Edson Leonard

A. S. Barnes & Co., $5.00
340 pp., 56 figs., 8 plates

MR. J. EDSON LEONARD has turned out a most exhaustive study on artificial flies for fishing. It is amazing that in such a relatively small volume he is able to treat in detail the complexities of so extensive a subject.

The book takes up Hooks in the first chapter, and systematically in thirteen more, for the beginner or the old hand, it preaches the gospel, "It is better to fish with a fly that will catch a trout than to hunt a trout that will take a fly."

The chapter titles include Tools, Materials, Fly Design, The Wet Fly, The Dry Fly, The Nymph, The Streamer, Surface Lures, Aquatic Insects, and Crustaceans, and there is a dictionary of 2200 fly patterns.

Flies is illustrated with black-and-white "how-to-do-it" drawings, which help make the intricacies of fly tying look simple. There are also full-color plates beautifully executed and faithfully reproduced. It is obvious that Mr. Leonard, who illustrated his own book, not only knows flies thoroughly but also has the precise hand of a talented artist, so necessary in presenting graphically the garnish to his words.

The book itself is so comprehensive and definitive that it may well become a standard reference for the fisherman flytier.

The chapter on insects breaks down the orders and families with charts, explaining visually as well as textually the natural fish foods found at certain times on the stream. The names of insects are in the vernacular of the fly fisherman rather than in entomological terminology. Mr. Leonard tells, further, how to imitate these insects, what size they should be, and when to fish them.

Flies is one of those books that prompts us to ask, "Why didn't the author do this long ago?"

Richard Salmon

Weeds, guardians of the soil

- - - - - by Joseph A. Cocannouer

Devin-Adair Co., $2.75
179 pp., 20 illusts.

THROUGHOUT his lifetime Mr. Cocannouer has been studying and experimenting with weeds, trying to find out what function they fill in relation to soil fertility. In this book he makes available his findings and gives suggestions for the use of weeds. These are some of his thought-provoking suggestions: allow weeds to grow interspersed with plowed crops as a means of protecting the soil from water and wind erosion; allow deep-rooted weeds to grow in cultivated areas because they bring minerals from the lower strata and make them available for some of the shallow-rooted domestic plants; use weeds as plant material to plow under as a green manure; use weeds as food; or use them to rejuvenate abandoned agricultural lands.

If the use of weeds is one of the means whereby soil fertility can be maintained, then the procedures advocated in this book certainly should be given serious thought.

This is a timely and important addition to conservation literature.

Farida A. Wiley

Lifelong boyhood

- - - - - - - - - - - - by Loye Miller

University of California Press, $2.75
226 pp., 5 plates

THIS is the autobiography of a naturalist, written in a simple, narrative style which holds the interest of the reader.

Loye Miller is an authority on fossil birds, and he has been an outdoors man with an intense interest in natural history from early childhood. He spent his years in the western United States, and he has been associated with men whose names are inseparably linked with the ultimate in field work and with leadership in the classroom. He has been well equipped by inclination and training to make the most of the field opportunities that have come to him.

The subtitle "Recollections of a Naturalist Afield" is a fair appraisal of the contents of the book. Only enough space is devoted to the author's family circumstances and academic career to serve as a background, and many of the pages deal with incidents in the field, often under almost pioneer conditions. The most memorable events of these expeditions are recounted in a fashion that can but recall nostalgic memories to any reader who knew the West at that time.

Miller treats his field work in chronological sequence and then passes to selected writings which highlight the uses to which he has put this field work. In his early trips he collected specimens of the recent birds, mammals, and reptiles, as well as fossil material on occasion. The articles he has chosen show his major interest to be in birds, both the recent living types and the extinct forms of the long ago. It stands to reason that a scientist will understand the birds of the past in direct relation to what he knows of the birds of today.

These papers are not in a language difficult for the layman; they are readily understandable and interesting. Several are on the behavior of living birds, a fruitful field for speculation and one to which much thought is given.

Harold E. Anthony

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Field Trip t

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▲ SIAKONG, the best spearfisherman in the Palaus, preparing to spear a fish from the bow of the boat. He holds the second spear for balance as well as for use in case the first spear misses its mark

AMNH photo

▲ THE AUTHOR in the laboratory of the Department of Animal Behavior at the American Museum of Natural History

◄ DR. CLARK was chiefly interested in poisonous fishes. At left she is seen wearing a face mask and holding the spear she used when fishing among the coral reefs

the South Seas

and beautiful fishes,

and visiting with natives

who had never before seen

a white woman —

all this and more in

one glorious dream come true

▲ NATIVES of Mog Mog (Ulithi) and an outrigger canoe. In the distance is the Navy ship that was used on the trip described in the article

By EUGENIE CLARK

Research Associate, Department of Animal Behavior, American Museum of Natural History

A GREAT deal has been written about the South Sea Islands—romantic novels about poets and painters and shipwrecked sailors. Travelogues, reports of expeditions, and World War II campaigns have made little specks in the Pacific of increasing interest and importance.

My hobby as a child was collecting tropical fishes—from pet shops. As much as some children wanted to become firemen or cowboys, I wanted to become an ichthyologist. I had daydreams about diving among corals and catching some of the beautiful fishes I'd seen pictured in books about South Sea islands. But even after seriously starting the study of fishes in college, I didn't really think that I would get the chance to collect tropical fishes first hand and see the South Pacific for myself.

Then one day at a science convention in New York the Executive Secretary of the Pacific Science Board told about some opportunities for a few persons to study in the South Seas as part of an Office of Naval Research program entitled "Scientific Investigations in Micronesia." I sent in an application, of course, but the forecast didn't look encouraging. Experienced persons who knew much about this area didn't think it likely that the Board would be willing to send a single woman around the Pacific collecting fishes. Life would be too rugged in most places, tropical diseases and the heat might get a girl down, and women fishermen aren't generally encouraged—especially in Micronesia, where some natives not only object to women on fishing trips but consider them bad luck or taboo.

It was then quite a surprise when a phone call from Washington came through saying that the Pacific Science Board was interested in learning more about the fishes of Micronesia and the identification of poisonous kinds, and asking whether I could be ready to leave for the South Pacific in a few weeks. While the almost incredible words continued to come out of the phone giving more details, a number of scattered thoughts rushed through my mind. That very morning I'd accepted an Atomic Energy Commission fellowship that conflicted with this trip; how could I have both? I was in the midst of some experiments for a doctoral thesis; could I finish them in time? And—wouldn't it be wonderful to see the South Pacific and be out of New York during my hay fever season!

It seemed like short notice, and yet once the arrangements were made, I couldn't wait to get started. An extension of the fellowship was granted, the American Museum of Natural History would sponsor the trip, and in general things worked out smoothly. I left the States on June 17 from Alameda by jet take-off aboard a huge double-decker Martin Mars seaplane of the Military Air Transportation Service—bound for Hawaii and points southwest.

In Honolulu there was a chance to do last minute shopping for a diving mask, jars of all sizes to preserve specimens, etc. At the University of Hawaii, the Bishop Museum, and the Waikiki Aquarium I discussed my proposed studies with Drs. Hiatt, Gosline and Edmundson, and with Mr. Tinker and others familiar with fish collecting in the Pacific. They were encouraging, and the prospects of the trip became more stimulating than ever.

After Hawaii the actual collecting trip began. On Kwajalein, Guam, and Saipan I obtained many varieties of reef fishes by poisoning tide pools. It was after reaching the Palau Islands, however, that I started collecting more selectively by spearfishing with the excellent

◄ IN THE ISLES of the South Pacific, Dr. Clark adopted the throw net in her search. Here she holds the net in the proper position for throwing

▼ WHEN RELEASED, the net is intended to spread open, but this was one of the author's first attempts, and something went wrong

help of skillful native divers. Fewer fishes were obtained, but I was able to secure the exact species I sought —the poisonous plectognath fishes. Moreover, spearfishing is the most pleasant method for the collector who enjoys swimming and observing fish in their natural habitat. In the Palaus, we spearfished around the islands of Koror, Babelthuap, Nemolis, and Kayangel, and on Angaur we even made one collection by dynamiting.

Every few months, from the base at Koror, the Navy sends out a ship on a "field trip" to some of the outlying islands of Micronesia. On these trips the Island Trading Company buys copra and handicraft from natives, who in turn buy cigarettes, cloth, canned goods, etc. from the Island Trading Company. It was my good fortune to be permitted to go along on two such trips. The first was to the little known southern islands in the Palau district: Sonsorol, Merir, Pulo Anna, and Tobi. The second trip was to the northernmost group of islands in the Carolines: Ngulu, Fais, and the Ulithi Atoll. It is about this second trip that I should like to tell you, for these islands struck me as the most fascinating and romantic of all those I had the chance to visit.

Aboard a Navy transport headed by Lt. Parnell, we left Koror at high tide on September 20. I knew two of the other passengers from the southern field trip—Lt. Stille, who was the officer in charge of native affairs, and Father Walter, a Jesuit priest who came along to give spiritual guidance to the natives.

The first night at sea, most of us gathered aft for the ship's popular evening diversion—an outdated, second-grade, black-and-white movie. This was shown on a canvas screen behind which the tropic sun had set in technicolor just a short time before—practically unnoticed. Brilliant sunsets at sea apparently get to be monotonous for sailors, who never tire of seeing movies. In addition to the main feature, there was a "sing" short during which the bouncing white ball was followed by the lusty voices of the Navy fellows, Father Walter, and even a few of the native passengers. During the "girls only"

section, my first yell subsided to a weak solo as I felt the rest of the audience turn to watch with amusement the lone female in their midst.

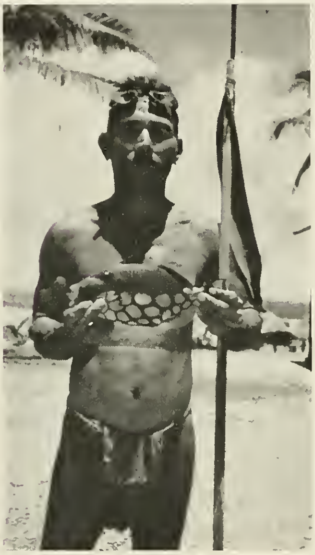
After the movie, Father Walter invited Mr. Stille and me to share some of his bouillon cube soup. This gave me the opportunity to ask about the islands we were going to visit. Mr. Stille had been the officer in charge of native affairs on the previous Ulithi field trip for the Island Trading Company. To Father Walter, these were "his islands," where he had already befriended the natives and was fast learning their language, and where he hoped to preach the gospel for the rest of his life. We talked about the natives, God, and fishes for over an hour before turning in.

Lying in my bunk, I started to preform pictures of Ngulu, the island we were due to reach in the morning, where I would see natives in grass skirts for the first time in my life. I might have stayed awake for hours in fanciful anticipation had not the soft whirr of an electric fan at my head and the gentle tipping of the ship under me put me quickly to sleep.

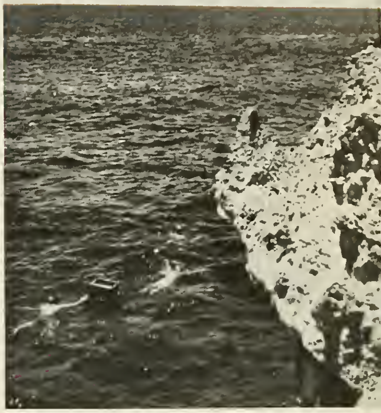
At 6:30 the next morning a knock at the door announced breakfast. We weren't due at Ngulu for a few hours, and so after breakfast I sat up at the bow and watched the flying fishes shoot out from under the ship.

We sighted the little island on the southern tip of the large Ngulu Atoll about 10 A.M. The last census, taken 3 months before, reported 52 natives here. Ngulu was similar to the other islands I'd seen on the southern field trip—at first just a little clump of coconut trees on the horizon seven miles away, and twenty minutes later a village of grass huts peeking out at one point. Coffee-skinned natives were slipping their little outriggers off the white coral beach into the shallow, pale green water over the wide-fringing reef. Out past the reef they paddled into the sudden deep blue waters to meet our ship and welcome us. I could hardly wait to get ashore and went in on the first returning outrigger.

▼ A NATIVE SPEARFISHERMAN of Sonsorol holding a poisonous triggerfish that he speared. He is wearing his double-duty swimming suit and full dress. Because he operates underwater, he uses a slingshot type of spear, equipped with a broad band of rubber which sends the shaft through the water



Unlike most of the other islands I visited, Ngulu did not have copra to sell. Their major products were sculptured wooden figures which the Island Trading Company called "frogmen." Actually they were heavy-browed, triangular-faced pregnant women symbolizing fertility. Several hundred figures ranging from a few inches to nearly two feet were lined up on the beach. Some were carefully carved in bold and interesting lines, whereas others were obviously chipped out hastily to meet the large demand last requested by the I.T.C., which was selling them back at Koror like hot cakes. Mr. Stille wisely bought only the well-carved figures and in his unoffending yet critical manner and gesticulating pidgin



▲ DYNAMITING FISH on Angaur in the Pala
Islands. The man on the cliff has just set o
the charge. Major Ed Richardson, who too
the picture, is shooting at the sharks tha
were attracted by the dead fish. Dr. Clar
and two native fishermen are in the wate
diving for the dead and stunned fish

▼ THE SMALL SAILBOAT that Dr. Clark an
her fishermen used to get to an underwate
fairyland of fishes and corals off the islan
of Kayangel

▲ **The author** sitting among the high chiefs of Fais, outside the "man's clubhouse." As an outsider, she was not expected to walk stooped over like the women of the island

▼ **The women** of the island of Fais were not allowed to stand upright in the presence of men

English let the natives know he was after quality as well as quantity.

The natives were exceedingly friendly. The women and children came up and patted my arms and held my hands. "You're probably the first white woman they've seen," Stille chuckled. The native women were highly interested in my bathing suit and fingered the gaily-colored material with curiosity and amusement. Stille consulted an interpreter and then reported, "They think your shorts are immodest and your bra superfluous." I couldn't be sure whether he was kidding or not. My outfit was a contrast to theirs. The women and girls wore heavy, bulky grass skirts almost to their ankles, and some had leaves and flowers around their heads or stuck through large holes in the lobes of their pierced ears. Their skirts had the pleasant smell of dried grass—a practical garb for these people, for soap and cloth are rare items. Instead of wearing ragged, patched clothes that accumulate odors with soapless washings, they merely toss away soiled clothes and string together a new skirt.

One young girl had reddish-orange paint on her forehead and cheeks, but her hair was cut short like a boy's. "It helps to keep the bugs out," I was told. This little girl, whom I nicknamed "Red," attached her hand in mine and did not let go until I went in fishing. She took me for a walk through the village, which was beautifully clean and ready for Stille's sanitary inspection. Some of the grass huts had stone or wooden foundations, and almost all the pathways and ground surrounding the huts had been covered with white coral pebbles. Garbage was carefully thrown into holes, where it was burned from time to time and finally covered over. These were teachings that the natives obediently accepted from the Navy, and they understood that the rules were for their own benefit.

At high tide Stille rounded up two Ngulu spearfishermen that spoke Japanese, and so I detached myself from Red and went out on the reef with them.

The tide began going out slowly, but it was still fine for spearfishing. We started from the north side of the island and worked toward the west. The fringing reef around this island was the most beautiful I have ever seen. Colored corals grew abundantly close to the shore, and with them were the rich fauna and flora that are usually found only toward the outer edge of fringing reefs. This was probably because the reef around this island slopes less abruptly into the deep water outside and ravines cut into the reef at frequent intervals. Just a few yards from shore we dropped into one of these ravines. It went down suddenly about five feet, and then we followed the ravine as it deepened to about thirty feet just at the edge of the fringing reef. Here it widened into a spacious submarine coral garden.

The younger of my spearfishermen scraped his arm on some coral while chasing a tiny poisonous puffer. He didn't seem to think the fishes I was after were worth it, and he left, saying that he was too tired to continue. The older fellow, who was more skilled and interested in the odd assortment of fishes I desired, stuck it out for several hours, laughing heartily at my enthusiasm over a little fish he would bring to me—completely worthless to him yet a rare specimen for my collection. At one point we saw a beautiful big orange triggerfish—the largest triggerfish I'd seen and a species I hadn't yet caught. I pointed to it excitedly, and through my face mask I saw my spearfisherman start after this fish that presented more of a challenge to him. The fish swam downward, out of our alcove to where the reef took a deep drop. The fisherman dived after it with his spear poised for a throw. He was down about 20 feet when a large shark swam slowly past above him. He saw the shark but with no alarm came to the surface, took a breath, and made a deeper dive in the same place to recover his spear, which had missed its target. The shark seemed about eight feet long, and I was growing uneasy about its return when I suddenly spotted a pair of barracudas, each about four feet long, approaching from my right side.

It was the first time I'd seen barracudas in the reefs in the Pacific and the first time I'd seen any of that size so close to me in the water. My spearfisherman had followed the orange triggerfish around a wall of coral and was out of sight. I started to recall some armchair discussions about barracudas, in which I had expressed my belief that barracudas do not normally attack forms as large as a man and that when they do, it is because they do not see the form as a whole but are attracted to some small light areas such as the palms of hands or the soles of kicking feet, which stand out as ruptive patterns on an otherwise dark body. Shiny rings and bracelets are thought to be especially attractive. And aren't barracudas caught by fast-trawling small, bright lures? I was deeply tanned, wearing a dark bathing suit, black *tabi* shoes, and no jewelry, and I was barely moving—but none of these thoughts comforted me.

The barracudas had stopped about six yards away and were resting almost motionless near the surface. I backed away easily from the center of the alcove to the rim of a wall of coral that reached within a few feet of the surface. I stood on this, watched the razor-toothed pair of fish through my face mask, and longed to see my spearfisherman. There was a loud splash in the water behind me. Startled and quite terrified, I turned only to see among the bubbles in the disturbed water the nude lower half of a young girl who had just dropped in next to the hull of an outrigger. I put my face mask above the water and saw Red's painted face laughing at me. What a welcome sight! She was hanging to the side of an outrigger in which she had left her bulky grass skirt. I was overjoyed to see her, and she felt it and swam happily toward me. I pointed to the barracudas before it occurred to me that she couldn't see them very well without a face mask or goggles. I motioned to her to climb into the boat, and after a last look at the large silver forms still in the alcove, I quickly followed. Some distance away I saw my spearfisherman come up for a breath. We called him over, but when I looked again the barracudas were gone, and his only reaction to my serious description of them was a giggle and the supposed-to-be comforting Japanese phrase, "*Abunakunai* (Not Dangerous)."

We paddled the outrigger a good distance from the alcove to continue our fishing. When we went back to the village, Stille was anxious to return to the ship, and we left hurriedly. I gave the usual salary to my spearfisherman plus a gift of cigarettes, and for Red I left some candy and chewing gum. Back on ship and ready to pull away from Ngulu, I spied Red and my spearfisherman among the group of outriggers bobbing about the stern of the ship, waving a last good-by to me. It didn't seem that our acquaintance had been for less than a day and that we'd exchanged but a few words of broken Japanese.

We arrived at Fais near noon of the following day. The native men came out to meet us in large outriggers of bright orange and black. When we reached shore, all the high chiefs of the island were sitting cross-legged in front of a large grass hut—"the men's house." Stille presented me to them, and I shook hands with each of them during an exchange of curious glances. Their faces were serious and dignified, and they presented a weirdly beautiful picture. Their bodies were heavily tattooed from the neck down with vertical stripes and designs of various types, some of which I made out to be fishes. One old chief had apparently tinted his gray hair and beard with the same shade of dye that "Red" on Ngulu had used on her face.

During most of the day the chiefs hardly budged from their original position. They chatted with us (two could speak some English), smoked the cigars Stille brought them, and were overseers while the other men rushed about loading copra, bringing us coconuts to drink, and waiting on the chiefs. Aside from the more elaborate tattooing and headdress, most of the chiefs could be readily distinguished from the common natives by their bulging bellies, fat bodies, and smoothly rounded and relaxed limbs, as com-

⮝ **Father Walter** (S. J.), formerly of Fordham University and now settled permanently in the Caroline Islands, celebrates mass for the natives of Ulithi, many of whom are Christians

pared to the slim, taut, muscular bodies of the "workers."

I became curious to see the women of this island. Stille and Father Walter had told me that instead of grass skirts, the mature females here wore laboriously hand-woven cloth skirts called lava laps. But there were no women around, and we had been on the island for over an hour. Some time later I noticed that one by one they were slipping out from behind coconut trees, walking in a peculiar, crouched-over position with their backs almost parallel to the ground. Stille then told me they had to walk like that in the presence of men—a law of feminine obsequiousness on that island that I was brazenly breaking! Ignorance of the law is no excuse, but the chiefs were lenient with me and never said a word.

I joined a few of the women sitting under some trees, and soon a large crowd of them gathered around. None of them spoke Japanese. I started a sign language conversation that was accompanied by sympathetic giggles and laughter, and the women reciprocated until we must have looked as though we were playing a game of charades.

Most of the older women's forearms and legs were tattooed, and they wore bracelets, beaded necklaces, and belts. The belts held up their colorful lava-lap skirts, which were folded in such a manner that the loose edges met in front, forming an attractive hanging fringe. Each woman carried a good-sized "pocketbook" made of a woven coconut frond and containing paraphernalia similar, I guess, to what most of us are prone to tag about with us (paint for the face, cigarettes, etc.).

The "number one" chief offered his two finest fishermen to help me with my collecting. We spent a profitable and enjoyable time spear-fishing at the end of the fringing reef. When we returned, all the copra had been brought to the ship. Mass and confession were over, and native affairs settled. The chiefs promised to stage a dance for us in the evening. We stayed for a supper of breadfruit, fish, and bananas with the natives, and then came the floor show. It was pitch dark by then, and a large bonfire was built on the beach. The evening was damp and cool. I'd given my dress to a chief's wife, who with the other women had greatly admired the bright-colored cotton print, and I was left wearing only my damp bathing suit. I welcomed the opportunity to push my mat into a warm, dry spot near the fire.

The men, I was told, would not dance because they were worn out from carrying the large sacks of copra, but the women were ready and willing to perform. They lined up in a row of fifteen. The center women were the oldest and obviously the leaders who knew the dances best. The breasts became firmer and higher toward the ends of the line, where the young girls made up in attractiveness what they lacked in dance training.

The dance started with the women stamping their feet in rhythm to a low chant. As the dance progressed, they hardly moved from their spot but turned in place, first to one side then the other, and sometimes completely around—the sinuous movements of their bodies becoming increasingly emphasized. Their arms hung loosely much of the time, but sometimes

⮟ **Ueg**, King of Ulithi, in his royal wagon. Since stricken with polio, the wise and kindly monarch has had to be carried or wheeled around his island

◄ **Dr. Clark**, with a diving mask on forehead and accompanied by two native spearfishermen, beside the rubber boat that proved useful when collecting specimens in Ulithi

they swayed in movements complimentary to those of the body or they waved about in rag-doll fashion slapping the thighs and buttocks from time to time. The girls at the ends of the line frequently missed their cues to turn at the right time and obviously bluffed through the words to parts of the chant. But their improvisations were of ceaseless charm to Stille. Father Walter, however, accustomed to these dances on his home island of Yap, played with the children and was the most casual spectator at the weird dance held in the light of a bonfire. The excitement mounted as the chanting grew louder and higher in pitch, ending finally in a sudden and abrupt mass yell.

We applauded enthusiastically. Some of the entertainers acted as if we weren't there; a few glanced our way and then giggled self-consciously. Then all eyes went to the center woman, who cued off, and a second dance began. The women had prepared a limited number of encores, at the end of which they all walked away, and the bonfires, perfectly timed, petered out to just a warm glow.

▼ **Lt. Harry Stille**, discussing business with the native chiefs of Fais

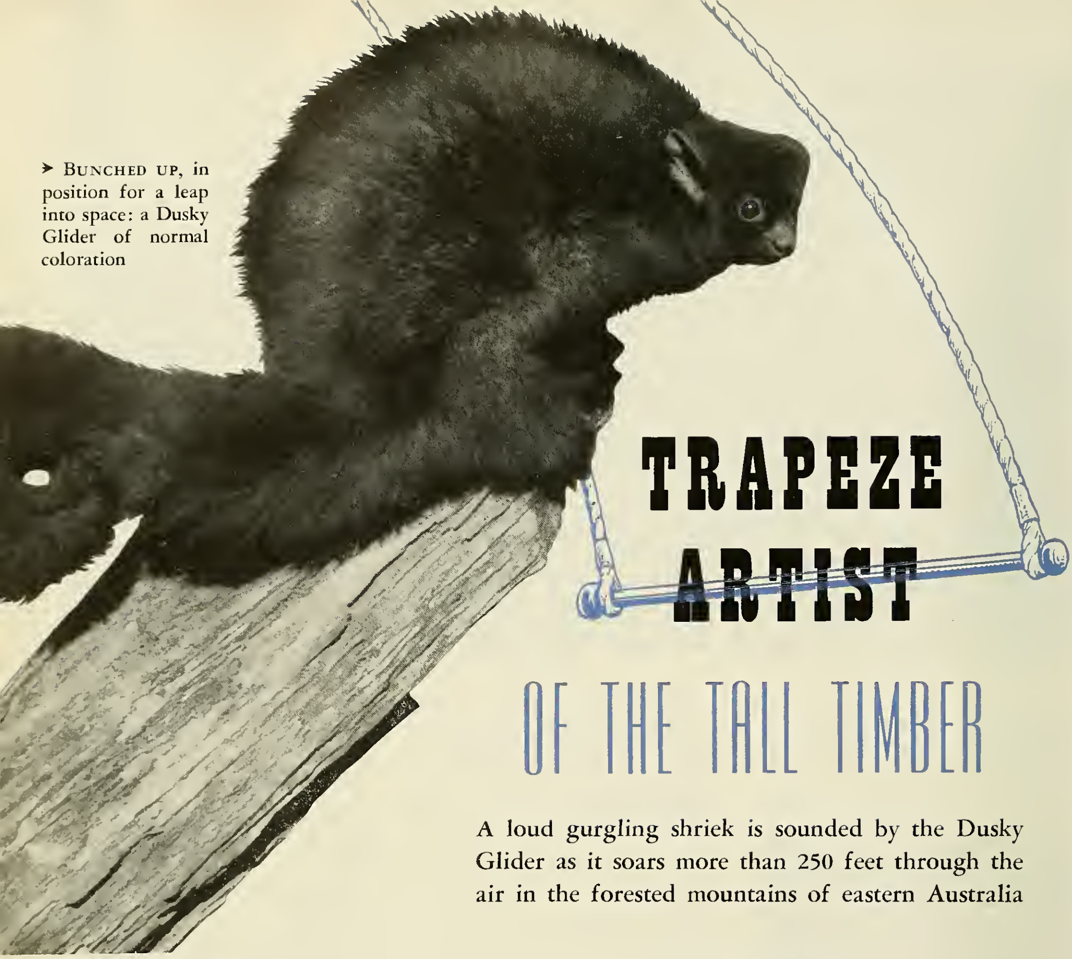
In the darkness we bade farewell to the people, thanked the chiefs, and returned to our ship. We didn't attend the "Western" that was being shown aft but turned in early after some of Father Walter's bouillon.

The following day we arrived at the sausage-shaped atoll called Ulithi. Although Ulithi is composed of some 49 islands, only 7 are inhabited. The villages on each of these are headed by one or more chiefs, but the supreme ruler of the Ulithians—the chief of chiefs—was King Ueg.

Our first stop was on the island of Mog Mog, where the King of Ulithi lived. I never dreamed that at my first meeting with a king I would be in my bare feet, bathing suit, and pigtails, with the king in a G-string!

Word of his coming reached us shortly after our arrival on the island. I had heard that King Ueg had been a polio victim some years back and was now unable to walk. I expected him to be brought out on a royal platform carried on the shoulders of his subjects, but I was mistaken. Instead, a lone native approached us pulling a little rubber-tired wagon in which sat the king. The royal wagon was a rather funny sight, and the withered lower limbs of its occupant were pathetic; but Ueg's face itself was truly majestic. He had a fine straight nose with firm nostrils, sharp blue eyes, highly arched eyebrows, and thick black, curly hair. The contours of his face were handsome. He looked dignified, wise, and kind, and although most of the time his expression was solemn, when he smiled it was with sincer-

Continued on page 46



➤ Bunched up, in position for a leap into space: a Dusky Glider of normal coloration

TRAPEZE ARTIST OF THE TALL TIMBER

A loud gurgling shriek is sounded by the Dusky Glider as it soars more than 250 feet through the air in the forested mountains of eastern Australia

By David Fleay

All photographs by the author

ONE of the really remarkable mammals in Australia is the largest species of parachuting or gliding possum—the Dusky Possum Glider or Greater Glider *(Schoinobates volans).* In over-all length, this skinny-framed "flying rope walker" may total forty inches, but over half of this is taken up by the pendulous, bushy tail. And though appearing to be a big creature, its weight averages a mere three pounds.

Normally dusky-black in color, with long, soft, and silky fur, the somber-hued creature is highly specialized for life among the great eucalypts of the eastern and southeastern highlands of Australia. The animal ascends the trunks of the gums with an extraordinary galloping motion, and when it lands at the end of an 80- to 90-yard swoop, its extremely sharp claws readily grasp the hard, smooth trunk of the tree.

Fully as distinctive as the Dusky Glider's unusual appearance is its musky, eucalyptus oil odor; and though the animal is thoroughly dainty and clean in a "gummy" fashion, it is not long before the lofty hollows that form its daylight retreats acquire this pungent, distinctive, though by no means disagreeable odor of musk and bruised gum leaves.

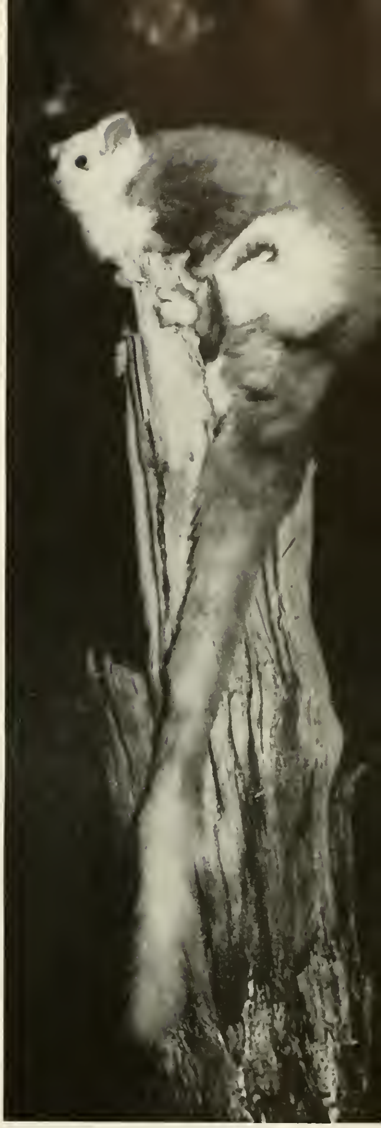
Although the Dusky Glider is the most numerous of the larger aboreal furred creatures in the forested mountain country of eastern Australia, it is one of the most delicate and difficult marsupials to maintain in captivity. It is the only gliding possum that is a leaf eater, and unless it is able to secure a select variety of eucalypt foliage, it simply will not live. In this respect it resembles the koala. Its diet is close to that of the common Ring-tailed Possum *(Pseudocheirus),* which most nearly represents the ancestral stock of the Dusky Glider. In both, the skull characters, teeth, and facial appearance are similar. In fact, we might call the Dusky Glider the "flying Ringtail" of the really big timber. The true Ringtail lives in the lower levels and cannot find a toe hold on the almost glass-smooth trunks of the great trees.

In typical specimens, there is a white area underneath, contrasting with the black of the back and tail. The large ears are thickly covered with fur on the outside but not on the inside. These, coupled with the bare pink nose and solemn eyes, invest the animal with that somber and wistful expression so often observed when it gazes forth from a lofty hollow after someone has tapped the base of the home tree with an ax. Though normally dusky-black, the general color is variable, ranging from dark animals, through others with smoke-gray flanks, to almost white and really white animals.

One of these large gliders shooting down through space on its aerial jaunts looks for all the world like a swiftly diving kite. Its volplaning membrane, unlike that in the genus *Petaurus* (Sugar and Yellow-bellied species), does not extend from the outer digit of the "hand" to the ankle of the hind foot. It stretches from the elbow of each forelimb to the ankle. Therefore, while in midair with the membrane outstretched, the animal tends to assume more of a triangular shape, with the apex forward.

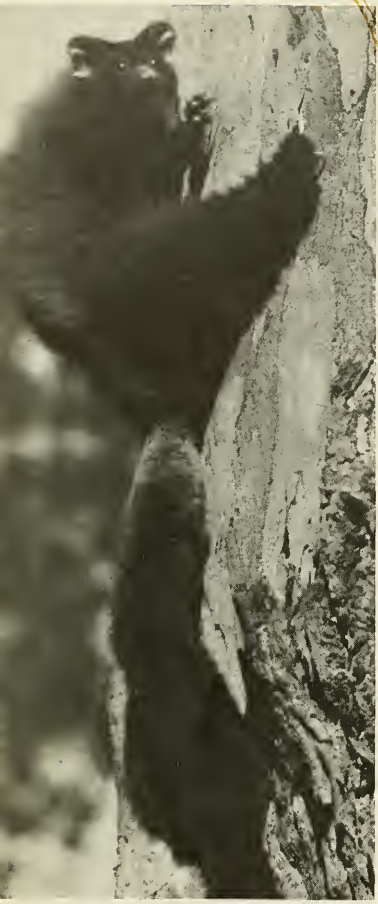
The home tree of the Dusky Glider is usually a large gnarled and knotted old giant, as often dead as not, and the nesting hole is high up in the trunk. From these daylight havens the inhabitants may be seen coming forth at deep dusk, stopping to comb their fur and scan the world of big trees before going about their nightly business. It appears that, though nests of stripped bark or leaves are built in these retreats, the black gliders are casual about embellishing their comforts. The species has apparently lost a good deal of the collecting and architectural ability of its Ringtail forebears.

The home trees are usually betrayed by varying degrees of shred-

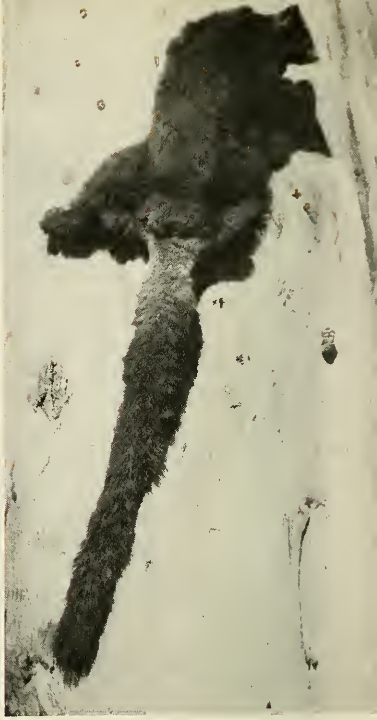


▲ A TAIL that is longer than the body does not prevent this creature from being one of the greatest gliders among wingless animals. The crinkled edge of its flying membrane is visible. In flight, this is stretched between the elbow and the ankle on each side. This is a partly white specimen

◀ A BEAUTIFUL smoky-bodied, white-headed female Glider recently found near the Murrundindi River in central Victoria



◄ NOTE the sharp, curved claws that enable the Dusky Glider to cling to the hard, smooth bark of the big trees at the end of an 80-yard glide



➤ AN "OLD MAN," distinguished by his lack of fur on rump and tail base, climbing the broad face of a great eucalypt

ding or scratching of the bark (depending on whether it is the stringy or smooth type), where the well-developed claws have scored the surface in "landing." To the experienced eye, the characteristic cross scratches on hard-barked eucalypts tell of frequent skidding stops made by volplaning possums.

One is usually able to determine whether the inhabitants are at home by striking resounding blows on the trunk with an ax. Soon a shaggy head may gaze forth, followed by the total emergence of one or two animals. Finding the vibration unpleasant, they proceed to climb upward with their characteristic galloping motion until finally they perch on the topmost point of the tree, their long tails waving loosely in the wind. Further blows at this juncture usually cause the animals to bunch up and leap forth, and then to glide away down some well-known aerial track to the safety of a trunk 40, 60, or even 80 yards away.

The mention of aerial tracks is not an exaggeration. Time and again I have noticed that, in springing forth with outstretched limbs from the upper boughs of the home trees, and setting out for nocturnal feeding grounds, Dusky Gliders travel in stages, using the same trees for landing and lobbing each time at much the same spot on the lower trunk.

Usually when tapped gently forth from an upper hollow, gliders wait until quiet reigns once more and then return slowly to the hole, rolling the long tail into a furry ring at the moment of re-entry. This action leads me to believe that when transporting nesting material, this animal may quite possibly carry it in a twist of the tail, just as I have seen the Ringtailed Possum and the Sugar Glider do.

The momentum that carries the glider such great distances is gained from the initial, almost vertical dive. Naturally, the higher the starting point, the farther the creature is able to glide. After the dive, it flattens out and finally sweeps gently upward for a landing, thus reducing the shock of its impact with the tree. Having lobbed, the glider climbs with its curious gallop into higher regions.

The Greater Glider, so much at home in the treetops and in the air, is a ludicrous sight on open ground. Its progress is extremely awkward and slow and may best be described as an undulating gallop—the main object being to find something to climb and find it quickly. Occasionally, however, either by accident or design, the animals do appear to journey across open spaces, risking destruction by the fox.

By observing captive specimens, I found that these strict leaf eaters were extremely fond of the common peppermint (*Eucalyptus australiana*) and Long-leaved Box (*E. elaeophora*). To a lesser extent they took Swamp Gum (*E. ovata*), Manna Gum (*E. viminalis*), Apple Box (*E. stuartiana*), Mountain Grey Gum (*E. goniocalyx*), River Red Gum (*E. camaldulensis*), and several species of stringy bark, but they showed a definite dislike for many other species. The almost cosmopolitan taste of other herbivorous possums, such as the Silver Gray and Ringtail, for succulent young leaves of almost any description is certainly not shared by *Schoinobates.*

Animals kept in confinement may be persuaded to acquire an additional taste for bread and milk spread with sweet jam or honey, but this is only possible as an adjunct to the diet of eucalypt leaves. Melon and lemon jam is a favorite with the Greater Glider, just as it is with numerous other marsupials.

It is interesting to note that, apart from the consideration of diet, the animals will not thrive in captivity unless supplied with a log or box fitted after the style of a "home tree" and situated in a lofty position in a roomy enclosure. Long sapling poles and stringy bark boughs are also provided, for seldom, unless sick, will the Greater Glider descend to the floor of its cage.

The breeding habits of the Dusky Glider are similar to those of other members of the possum family, except that the development of the offspring is rather slow. Like other possums, it is a pouched animal, or marsupial. Only two mammae are found in the pouch, and as in the genus *Trichosurus* (the Silver-gray and Short-eared Possums), only one embryo is reared at a time. In Victoria, this minute naked creature seems to appear usually in July or August; and it is difficult to realize that such a mite, no longer than the head of a thumb tack, may indulge some day in graceful aerial "flights."

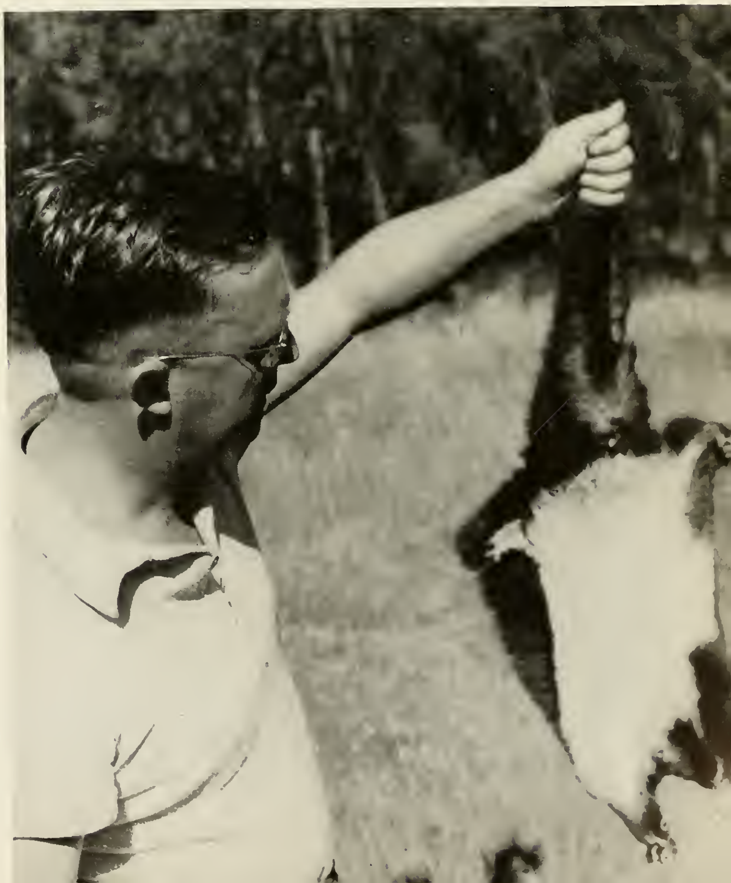
Like any other young marsupial, it makes its early journey into the pouch entirely under its own steam. Gradually as the youngster increases in bulk, it becomes evident that the limbs and tail are extraordinarily long, and the loose volplaning membrane from fore to hind legs is plainly visible. The color of the furless embryo is pink, with very dark ears. Naturally, all inspections of the pouch are conducted under difficulties, for the mother resents the handling, and there is also considerable danger of harming the infant.

The joey appears to become free of its attachment to the mother when some six weeks of age. It is then able to attach itself to the source of nourishment or relinquish it at will. Later the eyes open, and a covering of short fur indicates more plainly than in the adult the contrast between the black-and-white upper and lower surfaces.

Between the time of growing fur and the forsaking of the mother's "pocket nursery," the young Greater Glider is one of the most curious and pathetic babes that one can imagine. Lanky legs, very long tail, and thin, weedy body combine to produce a most extraordinary little creature. There is a period during which the little joey spends its daylight hours outside the maternal shelter and is carried about in it by night. Before the animal is four months old it has outgrown the pouch (though it still gets its nourishment there), and then the little glider may cling to its mother's back during her nocturnal wanderings. For her the gliding leaps are no longer possible unless the youngster remains in the home tree or sleeping hollow.

Throughout 1925-27, I had in captivity a pair of Dusky Gliders from the Daylesford district, and during this time they produced several young. Generally the single joey arrived in early August, but strange to say, none of these offspring grew to maturity; they died shortly after leaving the pouch. In later, more successful experiments I found that particular care was necessary as the weaning phase was reached. The baby animal required a most careful selection of gum tips, not only in regard to species but also to the maturity and delicacy of the branch tips themselves.

You may wander under the trees without ever discovering the Dusky Gliders feeding overhead, unless you listen intently. Perhaps the



➤ **THE GLIDING MEMBRANE** broadens as it extends from elbows to ankles. When soaring swiftly from one tree to another, the animal looks like a triangular kite with a long furry tail faint sound of a leaf being pulled from a stalk, or a sudden rustle as the animal shifts its weight from one slender limb to another, betrays its position to a searching torch beam held so that the observer's eyes look straight along the path of light. Then the blazing orbs of the animal, certainly the most brilliant light reflectors I know of among marsupials, regard the intruder with some curiosity. But this curiosity is scarcely sufficient to interrupt the meal. Soon the glider puts forth a long forearm to pull more leaves within reach, or moves to a more favorable position, its rangy shape and very long tail dimly silhouetted against the starry heavens.

The startling and extraordinary call of the Greater Glider, heard so frequently in the tall bush by night, particularly in the late autumn, is one of the animal's most distinctive characteristics. It is a loud gurgling shriek running down the scale in a bubbling or even chuckling fashion, accelerating though diminishing in volume. It is uttered mainly while the marsupials are moving actively and indulging in gliding leaps. One hears the initial loud notes, then a rapid gurgle diminishing perhaps with the increase in distance, for by then the swiftly traveling vocalist is shooting at speed to a point perhaps 80 yards farther on through the trees. The calling ceases upon its arrival, when the characteristic "clop" of landing is heard.

From close watching and listening, I think it is certain that these cries are a means of keeping in touch, because members of a pair move through the bush on a "follow the leader" principle. The animals are particularly attached to each other, and the gurgling shrieks, so typical of the deep forest, are really signal cries—an accomplishment far beyond the powers of nongliding possums and one that was probably developed in conjunction with their powers of flight.

It is fortunate that from a commercial point of view the Dusky's skin is extremely thin and papery, and the soft silky fur lacks permanent rigidity. This, combined with the fact that the animals have an inseparable attachment for dense forest lands and do no economic damage whatever, makes it unlikely that man will molest them. Bush fires, however, are the scourge and bane of these animals. They become utterly helpless, and I have watched them twirling in agonized bewilderment down into the onrush of consuming flames. In the holocaust of early 1939, tens of thousands of these volplaning creatures perished in the Victorian ranges, and many that survived in odd sheltered gullies died subsequently of starvation, because the leaves of their food trees, where not consumed by fire, were blasted and withered. For weeks after the flames had died on Mount Riddell and Mount Toolebewong, we found tortured Greater Gliders crawling weakly over the charred ground, their black color camouflaging them amid that desolate world of stark, dreary ashes.

The extraordinary rehabilitation of the species after the dreadful fire is remarkable, considering that a pair of Greater Gliders rears but a single youngster a year. In the middle 1940's, during many nocturnal quests on the slopes of Mount Riddell, Healesville, I was amazed to find the big gliders quite numerous again. Certainly the deep valley of Badger Creek was not entirely devastated by fire, but judging from the surviving stock in this valley, and perhaps in others far away, it is evident that an increase must have occurred.

The Dusky's one consistent enemy is the Powerful Owl, a great bird of the night that is really dependent on the Greater Glider and Ring-tailed Possum for its meals. This largest yet shyest of Australian owls dwells in the same country as the Dusky. While I was making a special study of this little-known bird of prey, I was amazed to find that it carried off at least one Greater Glider or Ringtail practically every night. In denser ranges, the victims were usually Greater Gliders. It is indeed fortunate that the Powerful Owl is a rare bird and therefore makes little impression on the population of this plentiful animal.

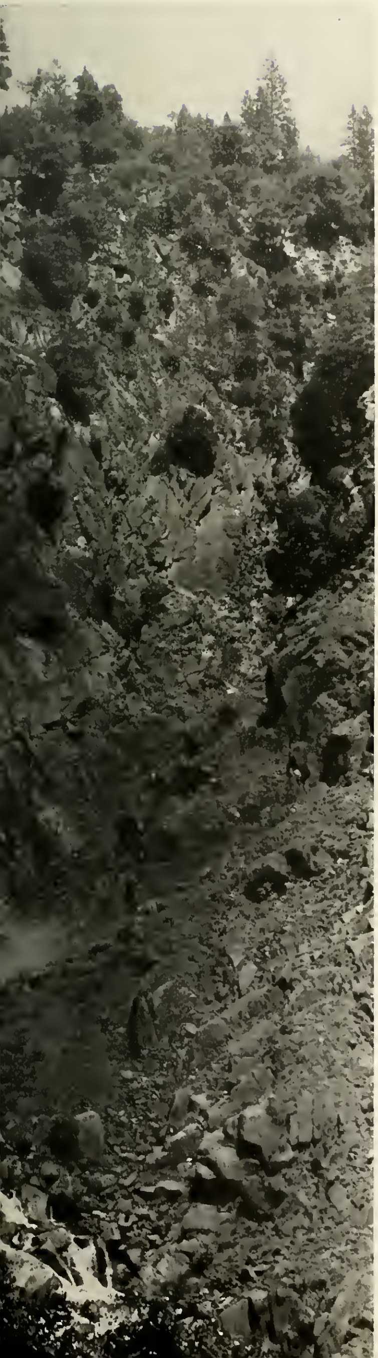
Feathe

Falls

The rediscovery of this spectacular cascade swings open the gates to one of northern California's least exploited wonderlands

By Philip Ferry

All photographs by Alfred Schmidt



▲ **The party** consults a Forest Service topographic map before getting under way for Feather Falls

THE Feather River Canyon country is one of northern California's more popular trout fishing grounds and one of its famed vacation resort areas. Notwithstanding these natural attractions, there are sections that have been little visited by the general public. The region is mountainous, with swift-flowing rivers, precipitous slopes, and narrow gorges that can be infernally hot. Hence it is not surprising that much of its rugged back country has been neglected by visitors.

This region jumped into sudden prominence early in 1950, when a starry-eyed flycaster came out of the wilderness to report excitedly that he had seen a magnificent waterfall of unbelievable proportions. The Forest Service, which had known about the fall for years, declared it to be 654 feet in height; and a California State Park Commission survey described the cascade as "one of the most beautiful in the state."

There are not more than a few dozen waterfalls in the world with a height of 600 feet, and our group immediately began making plans to investigate this latter-day natural wonder. Just one week before our visit, a leading San Francisco newspaper carried a feature story on the area. Black-and-white photographs accompanying the story vouched for the size and beauty of the waterfall. Late last June our group of seven spent two days at the site.

The fall goes into the middle fork of Feather River, in the Plumas National Forest, Butte County, California. From Oroville, a winding road leads up into the foothills of the Sierra to the hamlet of Feather Falls, a one-industry logging town. Five miles beyond the town we took

◄ **The 654-foot cascade** flows the year round and has even more volume at some seasons than in June, when this photograph was taken

▲ AS YET visited by relatively few persons, this fall is one of the outstanding features of its kind in America. Its height is about four times as great as Niagara Falls

a dirt road that headed west. This portion of the drive is made through a dense forest of sugar pine, yellow pine, incense cedar, Douglas fir, black oak, azalea, and dogwood. The road is poorly marked, and it is necessary to obtain full driving directions in the hamlet of Feather Falls.

Five miles on this primitive road brought us to a spot called Red Point, where we parked the car at the head of the steep foot trail leading down to Fall River. Shouldering our backpacks, we set out down the trail for Feather Falls. It is not necessary to backpack into the canyon. The trip to the top of the fall and back can be made in a single day—a long hard day—on foot. But since we planned to stay two days, we carried the necessary equipment.

The first leg of the hike, down an exceedingly steep, neglected hillside trail, proves a trap to the unwary, for the 1200-foot ascent later in the day finds him reaching the rim completely exhausted. However, there are compensatory rewards at the trail's end. A half hour on the trail brought us to the cabin of "Indian Al" Williams, an elderly man who looks after the holdings of the Watson family. The Watsons took up the land a generation ago, at a time when homesteading was permitted in national forests, and the family still holds title to the property. We were fortunate to meet Gerald Watson, one of the younger members of this extensive clan. He volunteered to join us on the following day and guide us to the base of the fall, over a trail we would never have found without his assistance.

We camped beside Fall River near the point where the cataract starts its plunge into the lower canyon. We spread our sleeping bags in a veritable forest of fragrant azalea. Roundabout was a generous display of late springtime wild flowers, including brodiaea, clarkia, collinsia, and penstemon — both the red and blue varieties. In the swift-flowing stream grew tall clumps of giant-leaved, umbrella-shaped Indian rhubarb (*Peltiphyllum peltatum*). Water ouzels dipped up and down on the flat boulders and ran along the smooth streamside granite, surveying the water for food.

We walked over massive granite boulders to the headwall, where the stream dropped away under our feet. There we got our first look at the fall, a perpendicular perspective straight down the length of the fall from top to bottom. The first astonished impression was that here was a first-class waterfall. This was not a local phenomenon that might pale beside other and more famous cascades. Feather Falls has a magnitude that is truly impressive. Aside from Yosemite Falls itself, it compares favorably with any cascade in Yosemite Valley—an area noted for its waterfalls.

Fall River, in forming the fall, charges down a narrow rock chute, spurts through a jumble of immense granite boulders, and cascades perhaps 100 feet to a broad apron. Here it drops into several potholes, describing some tremendous water wheels in its flight, and finally it leaps several hundred feet down the perpendicular wall. It is a noisy, boisterous, plunging body of flying water, which crashes against the rocky bottom with an explosive impact.

Young Watson, who was born and raised in the immediate vicinity, says the stream flows the year round. The area gets only about two feet of snow in winter, and the stream does not freeze. While we were highly impressed with the volume of water flowing in late June, Watson assured us that the volume is much greater in the early spring months. The gorge into which the fall plunges is a U-shaped box canyon, and the fall is located at the very end of the canyon. A footpath constructed by the Forest Service some years ago circles the head of the canyon on three sides, affording tantalizing glimpses of the fall. Perhaps the Forest Service may see fit one day to remove much of the vegetation that now screens the fall from the trail. At the present time, a full-length view can be obtained only by scrambling part way down the wall to a rocky perch opposite the fall.

The canyon bottom is choked with mammoth boulders, through which the stream charges with a mighty clatter. The canyon is narrow at this point, and the flying spray drenches the opposing wall, clothing it in lush greenery and filling the gorge with rainbows that arch the canyon from wall to wall. The runoff from the fall forms a full-sized stream, which flows down the canyon some three miles to be completely swallowed up by the middle fork of Feather River.

It is not necessary to descend to the base of the fall, and the inexperienced are cautioned against undertaking this second drop unless they are prepared to do some rugged climbing and to withstand some broiling hours in the sun. By remaining at the middle level and reaching the rocky perch on the wall opposite the waterfall, one can take in all the beauty without making the exhausting drop to the river's lower brink.

The actual discovery of Feather Falls is attributed to two members of a United States Geological Survey, who were the first white men to penetrate the Grand Gorge of the middle fork of the Feather River, sometime around 1888. The announcement of the discovery caused a tremendous stir, and in the enthusiasm of the moment the fall was billed as "another Yosemite." Sometime in 1913, the fall was rediscovered and came in for more publicity. Again the furor died down, and the fall lapsed into obscurity. It was known only to local residents and a few unimpressed sportsmen—in spite of the fact that Forest Service topographical maps of the area invariably included the fall, and at least one automobile club noted its presence on their road maps. This neglect was due, of course, to the difficult nature of the terrain and to the fact that all reports placed the fall in an "impassable" canyon. While much of the surrounding country is extremely rugged (the canyon of the middle fork reaches a depth of 3000 feet), it is unlikely that any of it is impassable. Feather Falls itself is readily accessible, as our visit demonstrated. Any normal person can make the descent from the road to the headwall of the fall in two hours; climbing back is, of course, a more difficult feat.

While the descent into Fall River canyon is a bit strenuous, it pales beside that of a notorious chasm located just over the ridge from the fall. Bald Rock Canyon is a local legend. Tradition pictures it as a veritable devil among canyons. Golden Land, who is an official of the lumber company, postmaster of the lumber town called Feather Falls, and an authority on local history, reports that only three parties are known to have penetrated Bald Rock Canyon for much of its length. Land himself led a party into the region some years ago, and while the men spent several days in the canyon system, they did not succeed in completely penetrating Bald Rock Canyon. In one short side canyon leading into the main gorge, the party counted 52 waterfalls upward of 10 feet in height. The gorge narrows in places so that it is necessary to climb out on occasion and rim around. The Forest Service contends that for all practical purposes portions of Bald Rock Canyon are impenetrable.

The Fall River section of the Plumas National Forest is one of California's few outstanding scenic areas still left unexploited. And Feather Falls, it is necessary to repeat, is a superlative waterfall. If the area is to be preserved while it still retains some of its original and as yet unspoiled beauty, there may be no time to lose in launching plans to have it made into a state or federal park. Experience has shown that in the realm of natural resources and preserves, what is once lost is irrecoverable. Nature has given us here a superb gift; it is for us to do our utmost to preserve it intact, both for ourselves and for future generations.

Surprisingly enough, the California State Park Commission has known about the fall for 25 years and once recommended that the area be incorporated in the State Park system, and a portion of the proposed 3000-mile master loop Riding and Hiking Trail extending from the Mexican to the Oregon border, will go through the Feather Falls area. Apparently the importance of the region has never been sufficiently emphasized, and as a result an unsuspecting public has remained apathetic. This attitude may prove fatal. Hanging over the area like a sword of Damocles is the ever-present threat of logging operations. In fact, timbering is already going on in the National Forest, within a few miles of the fall. Since logging is the sole support of the near-by hamlet of Feather Falls, this is not surprising. The operations have already extended into the Fall River section and adjacent private lands. This would drastically alter the status of the watershed and adversely affect the volume of the river and, as a natural corollary, the flow of the fall.

Unhappily, those holding homestead patents within the National Forest are most anxious to have lumbering extended into their holdings. This is only natural. Standing timber is a frozen liability, while lumber is a negotiable asset. Since at least one of these private holdings virtually abuts on Feather Falls (in fact, one family actually lays claim to the fall!), it is obvious that the dark cloud hanging over the area is no mirage.

This is a threat that is not to be taken lightly, for the rewards at stake are too valuable to be relinquished without a struggle.

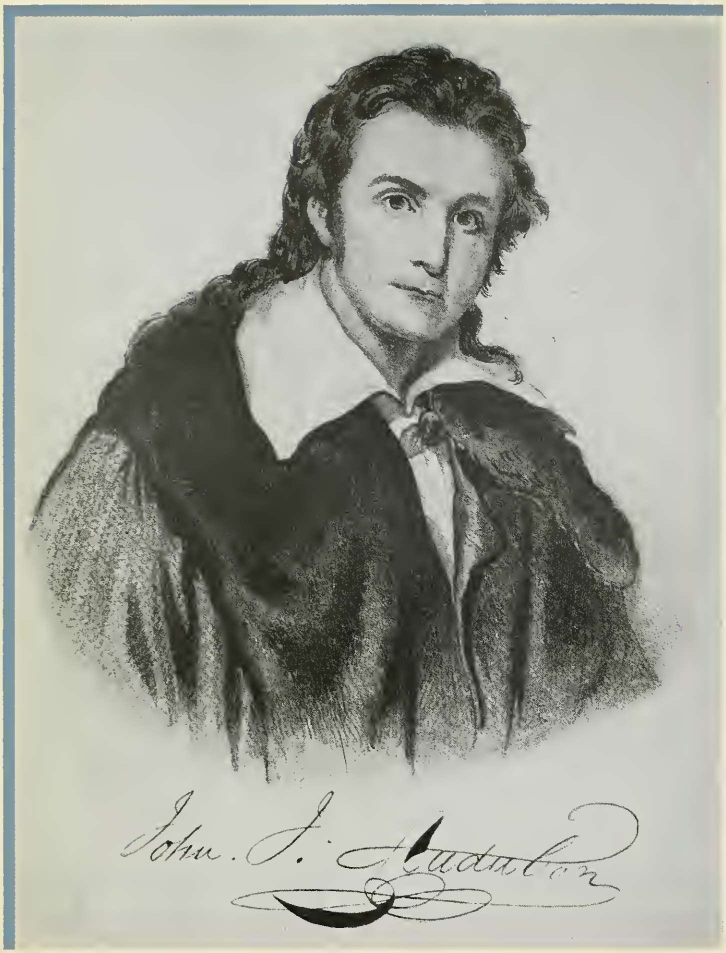
This month, on the 100th A

With *Audubon* in the FLORIDA KEYS

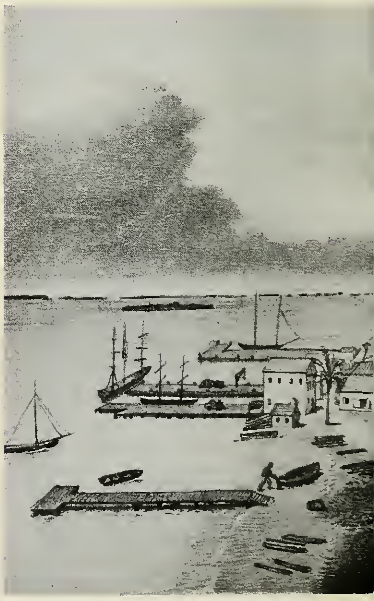
By Lucy Salamanca

IT is remarkable that only sparse recognition has been given to the extraordinary effect his sojourn in the Florida Keys had upon the eminent naturalist John James Audubon. His visit to the region not only revived his discouraged spirit but left its beneficent mark upon the work that was his legacy to mankind. The Keys gave back to Audubon that young and fresh delight he had once taken in the whole natural world and which had well-nigh been lost to him amid the uncertainties, deferments, and unrewarded exertions that marked his struggle toward the dream of his maturity—to catalogue and paint the birds of America in their native habitats.

Moreover, his visit to these islands that fringe the southeastern coast line of the United States, stands today as perhaps the most exciting,



◄ **JOHN J. AUDUBON** at the time he made the trip to Key West in the early 1800's



of the great naturalist's death, we can thrill to the little-known interlude that marked a dramatic turning point in the career of John J. Audubon

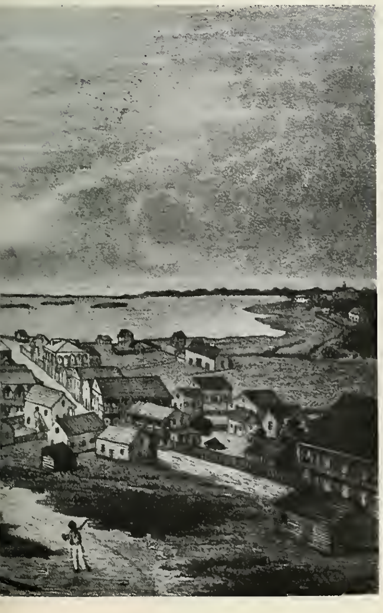
colorful, and fruitful interlude in the life of the gifted and devoted naturalist. Certainly it had in it all those elements that appeal to the adventuresome spirit of man. Audubon made the most of every moment, trailing after unlicensed wreckers through the waters of Gulf and Ocean on the storied "Lady of the Green Mantle"; searching in the clear waters of cove and bay, like a bobbing duck, for rare marine shells; exploring jungles of tamarind and bamboo, wading through saw grass and custard bushes, and losing himself in groves of satinwood; racing ahead of an oncoming hurricane in a bark so light it "shivered like a leaf"; watching out the sublime and awful storm from a dank mangrove swamp; discovering, with that relish known only to the ardent naturalist, a bird entirely new to science; and enjoying the charm and hospitality of the Key West citizenry in a day when lavishness and generosity marked their relationships with their fellow man.

It must have been a rich, heart-warming, rewarding interlude for one who had recently lived through a series of harassing, discouraging experiences and had made his way southward drained of earlier enthusiasm, on a dogged mission that lacked the buoyancy and spontaneity that had companioned him in his youth.

In London, where he had found himself with a lone sovereign in his pocket and where, by his own confession, he did not know of a single individual from whom he could borrow another, he had resolved to return to the United States and make the first definite step toward exploring the Florida Keys. Before this was brought about, however, $40,000 had passed through his hands for the completion of the first volume of his *Birds of America*. Four years had been required to bring out that volume, and in that time fifty of the subscribers, representing the sum of $56,000, had abandoned him. "With all my constant exertions, fatigues, and vexations," he wrote Lucy, his wife, from England, "I find myself now having but 130 standing names on my list."

Tantalizing rumors had come to Audubon most of his life about the rare and diverse bird life to be found in the southeastern woods and hammocks and beaches of the United States, especially along the coasts of the fabled Keys. These magic isles were known more for their smugglers and pirates and

▼ KEY WEST as it looked to Audubon in 1832: an early view showing the water front at Duval Street



▼ THE "OLD GEIGER HOUSE," where Audubon was a guest during his stay in the "southernmost city" in 1832. This was once the home of Captain John Geiger, licensed pilot of a wrecking vessel in Key West, Florida. The house was built from wood floated over originally from the near-by Bahamas and is still a distinguished and handsome residence

Photo by Jeff Brodhead

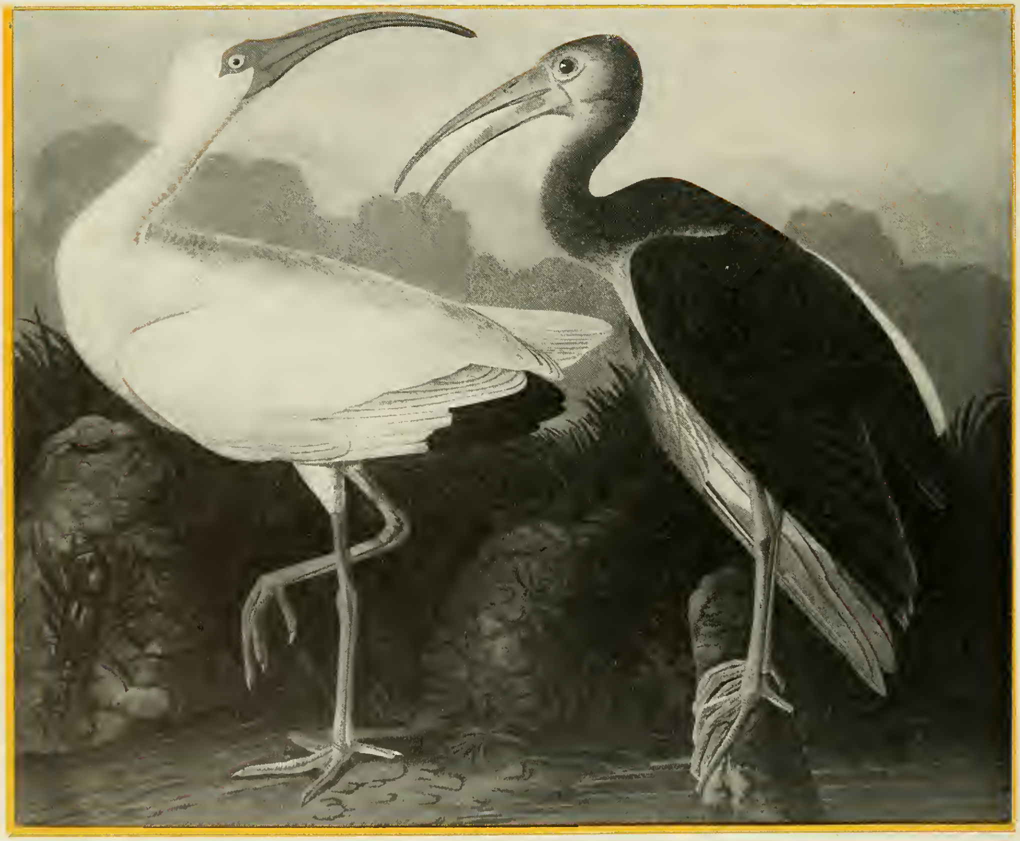
those hardened despoilers dubbed "wreckers" than for their characteristic native beauty. From the time he had known Boone in Kentucky, Audubon's imagination had been captivated by the possibilities these secluded islets might hold for scientific exploration. The "stupendous task" to which he had dedicated his life had driven him at one time or another mercilously down the Ohio and Mississippi, back to Louisiana, in and out of an unsuccessful business enterprise and a variety of uncongenial and makeshift jobs. The lean, hard years had worn his hopes thin and taken the edge off his ardor. Frustration after frustration marked his efforts, yet he had never relinquished his resolve to discover, study, catalogue, and paint America's birds.

At this period of his life he had grown dissatisfied with earlier work and had decided that some 50 of his paintings were not good enough for publication. Among other things, he wanted a wider representation of water and wading birds. So his dream of the Keys grew lively in his mind, and in 1832 he waited in St. Augustine to take the first step toward its realization. A government ship had been promised for the projected trip. The schooner would convey him to the Keys and, once there, put smaller craft at his disposal as his needs crystallized. But the schooner failed to show up, and he was forced to spend four grueling months of expectant waiting, knowing that he might be stranded for years, so infrequent was the passage of coastwise vessels.

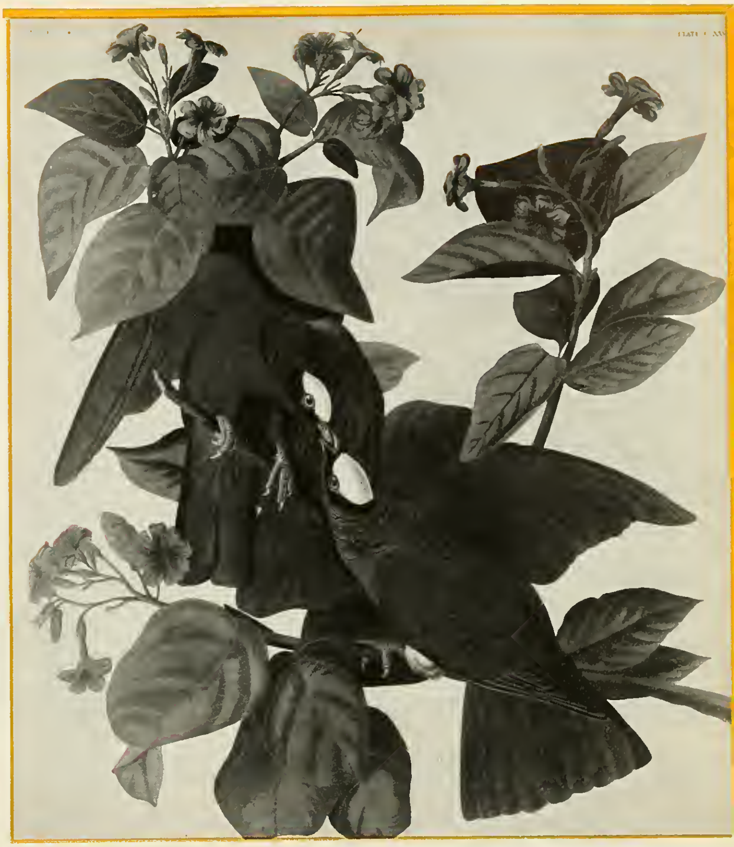
He spent the period as profitably as he could, collecting more than a thousand bird skins and hundreds of rare Florida shells and adding a number of paintings of bird life to his expanding portfolio. At length, friends in Washington arranged for a revenue cutter that was headed for the Keys to pick him up.

The day he stepped aboard the "Marion"—known to smugglers and wreckers of the Florida coasts as "The Lady of the Green Mantle"—he entered upon what was perhaps the most keenly enjoyed and profitable adventure of his life. When he caught sight for the first time of that chain of islands flung like a shimmering green scarf upon the blue waters of sea and gulf, the last vestige of discouragement slipped from him. He saw the elusive Keys as a strange and challenging new world

▼ THE WHITE IBIS, a beautiful bird that entranced Audubon when he saw it in great abundance on his expedition to Sandy Key. Drawn from nature by John J. Audubon



—his to explore at will and to study and observe and enjoy. Approaching Indian Key, he leaned breathless across the rail to look down into the dazzling coral reef that glittered beneath the blue-green water. Once ashore, he walked with the tremulous expectancy of the discoverer amid strange leaves and palms and brilliant flowers. He trailed inquiring fingers over the silvered surfaces of the sea grape's leaves, clustering in sandy stretches along the shore, and peered into the mangroves that stood on croquet-wicket feet above the shallow waters of the coves.



▲ **Of this beautiful bird**, the White-crowned Pigeon, Audubon said, "How can I ever hope to paint it?" This reproduction of Audubon's painting shows the bird on stems of a plant Audubon named the Geiger flower, in honor of his Key West host, Captain John Geiger. He found the flower in the garden of his friend, Dr. Benjamin B. Strobel, an early settler of Key West. This "rough-leaved cordia" is still the "Geiger flower" to Key Westers

hoto by Allan D. Cruickshank, National Audubon Society

▲ **Because** the White Ibis lacked the nuptial plumes that nearly sealed the fate of the egrets, and now that the Everglades National Park offers sanctuary to it, this bird is holding its own

Enchanted with all he saw and heard, he spent hours idling along the shallow lagoons that were dark with violet shadows. In deeper waters he traced the angelfish's feathery plumes, the green and scarlet flashes of the parrot fish, the fragile lavenders and blues and pinks of the water fans and gracefully waving sea anemones, the sudden sheen of the shell of a conch trundling across the floor of the sea. And above him and around in every direction wheeled and cried and whirred thousands of birds, and thousands more nested or stalked or fed or chattered in the swamps, along the shores, in the heart of the thickets. It seemed to Audubon that the world of bird life had opened for him here, and he felt his own inadequacy in face of its countless kinds and numbers. Later, in Key West, contemplating the lovely white-crowned pigeon, he asked despairingly, "How can I ever hope to paint it?"

These Keys were to prove a magic world to him. They were to restore to him his youthful enthusiasm, sharpen his awareness as a scientific observer, and provide the stimulus he needed so sorely to give fresh and glowing expression to his genius. Out of his experiences here, his sketches were to take on something more than their customary precision of line or nicety of detail and color. They were to capture in a measure the very atmosphere of the Keys and of that diffused light that plays across their wet sands, glittering beaches, and translucent areas of water. His snowy herons and egrets, his sandpipers and cormorants and curlews and ibises, caught the sheen of it on breasts and wing tips and crests, and his paintings came to life.

Much of the color and excitement of Audubon's stay in the Keys resulted from a peculiar situation existing there at the time. When civil government was established in the newly purchased Territory of Florida in 1822, the United States authorities found that a veritable hornet's nest of rough seamen were conducting a flourishing business on the Keys, in an enterprise known as "wrecking." Many of these seamen had come originally from the Island of New Providence—a Bahaman rendezvous that had harbored many pirates in its time. Nassau was the center of a system of maritime theft and hijacking backed, in many instances, by merchants of the town. These individuals built, bought or equipped vessels and sent them out, manned by unsavory characters for the most part, to prowl under signed articles not unlike those of the old-time buccaneers. Payment was on a share basis, with part of the proceeds going to the outfitter or owner and the other half divided between captain and crew. The government of the islands appropriated about 35 per cent of the gross sales of the property brought in, under guise of government duties, admiralty fees, tithes to the resident governor, and a variety of other charges.

The wrecking grounds for these groups extended down the entire irregular line of the Keys to the Tortugas, but the favorite grounds were around Key West and Key Tavernier. Some 50 vessels made Tavernier their rendezvous, for the coral bar known as Carysfort Reef due east of there was a constant danger to seamen in those uncharted waters. Here the winds, tides, and currents played into the hands of the wreckers. They lurked in a small harbor just inside the reef and waited for their prey. If the fees they set for piloting distressed ships to safety were rejected, they had only to wait for the master to run aground, whereupon they would strip the vessel clean. The loot was more valuable, in any event, than the fees asked for piloting, though the fees were considerable. Sometimes between $2000 and $3000 were wrung from unfortunate mariners. Charles Vignoles, the United States Government surveyor who visited the Keys in 1823, reported that duties paid the British government alone were estimated to average more than £15,000 annually—about $75,000 at the time.

As may be expected, the activities of these wreckers extended in slow seasons beyond pilotage and the stripping of wrecks. They engaged in smuggling on the side and were not at all above promoting shipwreck when spoils warranted. Many spent their time in off-periods treasure hunting in the waters off Key West, where the timbers and galleons sunk in Spain's heyday were still visible in the clear waters of the reefs. Farther north they sought the treasures of dead pirates, who were known to have buried their loot among the Keys.

In 1823, Commodore David Porter was sent to Key West, charged with the mission of ridding the Caribbean of pirates. With the aid of small light-draft schooners and five twenty-oared barges towed by an old New York ferryboat, Porter eventually captured the last remaining buccaneers and opened the island to settlers.

The wreckers from the Bahamas and Cuba had been accustomed to convey vessels and cargoes from the Florida reefs to Nassau and Havana for adjudication of salvage claims. After Florida was ceded to the United States, Congress, on March 3, 1825, passed a law prescribing that all property taken from a wreck in these seas, or from any of the Keys or shoals within the jurisdiction of the United States on the coast of Florida, should be brought to some port of entry within the jurisdiction of the United States. In good years, thereafter, sales in connection with these goods ran up to as much as $1,500,000. By the time Audubon visited Key West in 1832, the city could boast the highest per-capita wealth of any city in the country.

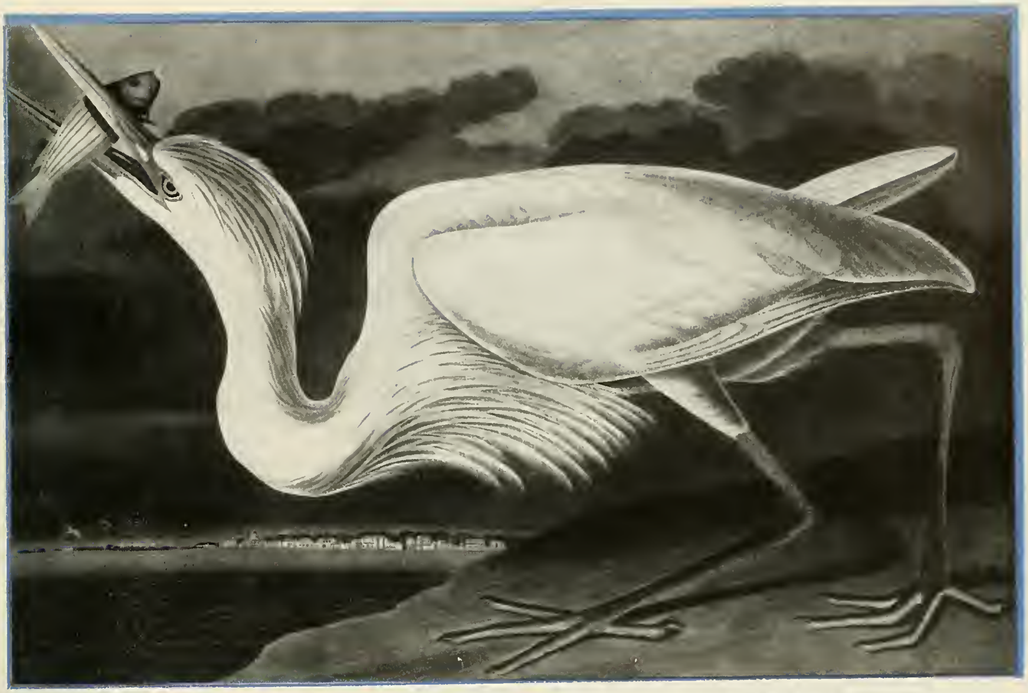
By that time, however, the business of wrecking had undergone something of a change from the old buccaneer days. In the early days vessels had sailed with skeleton rations—a few barrels of salt pork and hard tack—and the crews had had to subsist mainly by fishing and hunting. Bona fide salvors were now licensed. Conditions had improved to such an extent, in fact, that Jefferson Browne could write of this period: "Those were the happy, insouciant days! The wrecker's life, though full of danger and hard toil at times, was jolly and carefree. Their crafts were well victualled and apparelled, and they would lie all night in safe anchorage, but be underway at daylight to cruise along the reef, on the lookout for vessels in distress. When one was found, as was an almost daily occurrence, it was 'all hands to work' night and day to relieve the ship before heavy weather would drive her further on the reef or cause her to bilge. When that catastrophe occurred, the cargo was saved by men working waist deep in water and afterwards by skin-diving."

It was from these same wrecks that Key West derived some of its first citizenry. Many a gentleman of family and means was shipwrecked in the vicinity and brought safely ashore by the salvors, only to develop a permanent interest in the island. When Audubon came to Key West in 1832, he was entertained by many of these gentlemen and their families in their fine houses; he also numbered many of the respectable "wreckers" among his friends.

As a matter of fact, he made his headquarters during his stay on the southernmost island at the home of Captain John Geiger, who was pilot of a wrecking vessel—a man described by a contemporary, Judge William Marvin of the newly established district court, as "a man of decided character and sort of commodore among his compeers."

Another good friend Audubon made in the thriving little city was Dr. Benjamin B. Strobel. It was in Dr. Strobel's yard that he found the plant known botanically as the "rough-leaved cordia"—"the Geiger flower" of the Key Westers. Upon its bough he painted his famed white-crowned pigeon.

Audubon was charmed and astonished by the friendliness and helpfulness of the wreckers. "Long before I reached the lovely islets that border the southeastern shores of the Floridas," he wrote in his journal, "the accounts I had heard of the wreckers had deeply prejudiced me against them. Often I had been informed of the cruel and cowardly methods which it was alleged they



▲ THE GREAT WHITE HERON, which Audubon discovered on Sandy Key and named *Ardea occidentalis.* It is the largest of the American herons, with a six- or seven-foot wingspread. Its entire American range lies within 100 miles of Key West. Note the old Key West water front in the background

City of Miami News Bureau photo

➤ FOUR YOUNG Wood Ibises at the nest awaiting food: a photograph taken at a rookery on Sandy Key, where Audubon first saw the bird

employed to lure vessels of all nations to the dreaded reefs, that they might plunder their cargoes and rob their crews and passengers of their effects. I therefore could have little desire to meet with such men under any circumstances, much less to become liable to receive their aid; and with the name of 'wrecker' there was associated in my mind ideas of piratical depredation, barbarous usage, and even murder."

He changed this impression soon after he arrived at the Keys. For one thing, it was the business of "The Lady of the Green Mantle" and of other ships like her to keep watch along the shores to make sure that no unlicensed ships or men were engaged in salvaging. Audubon accompanied her on one such cruise as far as the Tortugas. He later described the scene as they left the Keys. Bales of cotton were floating in the coves and far out into the Gulf. Far beyond the reef he saw the dismantled hull of a ship that had been driven there by a brief hurricane. Later, in the Tortugas, Audubon boarded a number of the wrecking vessels and admired their form, their great breadth of beam, their light draft, their neatness and smoothness, and the beauty of their rigging.

"We were welcomed on board," he said later, "with all the frankness of our native tars. Silence and order prevailed. The commander and second officer led us into a spacious cabin, well-lighted and furnished with every convenience for fifteen or more passengers." In the scene that follows we have a nice example of the common appeal of the things of nature, among people of very different temperament. The captain brought Audubon his collection of marine shells and, in Audubon's

Photo by Allan D. Cruickshank, National Audubon Society

▲ AMERICAN EGRET—a pure white bird with a wingspread of three feet or more

words, "Whenever I pointed out one I had never seen before, offered it with so much kindness that I found it necessary to be careful in expressing my admiration of any particular shell."

The wrecker captain also owned many eggs of rare birds, all of which he handed over to the naturalist, assuring him that he could easily procure a new set within a month's time. "We have much idle time on our hands on the reefs this season," the captain explained.

Audubon dined aboard and enjoyed himself thoroughly while showing the men some of his drawings. The next morning a number of the wreckers accompanied him to Booby Island, a small Key near by. They rowed with long steady strokes in small boats, racing good-naturedly with one another and passing the time in singing sea songs. Audubon's friend, Dr. Strobel, had acquainted him earlier with the wreckers' song:*

* * *

Come all ye good people one and all,
Come listen to my song;
A few remarks I have to make
Which won't be very long.
'Tis of our vessel, stout and good
As ever yet was built of wood;
Along the reef where the breakers roar,
The wreckers of the Florida shore.

Key Tavernier's our rendezvous,
At anchor there we lie;
And see the vessels in the Gulf
Carelessly passing by.
When night comes on we dance and sing,
Whilst the current some vessel is floating in;
When daylight comes, a ship's on shore,
Among the rocks where the breakers roar.

* * *

It was this group of wreckers that took Audubon on a shell-hunting expedition, and they bobbed about in the waves, diving for the finer specimens. Before the "Lady" departed, Audubon was again invited aboard the wrecker, and on this occasion he was presented with superb shells, corals, live hawksbill turtles, and a great quantity of eggs. The only thing asked in return was that he put some letters in the mail for them when he reached Charleston, for their wives "down east."

As he said good-by to his new friends, Audubon was moved to philosophize, "How different is often the knowledge of things acquired from personal observation, from that obtained by report."

Shortly after his arrival at Indian Key, a small boat had been put at the naturalist's disposal, with a pilot and some fishermen who knew these waters. They skirted Indian Key and rowed off from the Matecumbes across the Bay of Florida for some 20 miles to Sandy Key, an L-shaped island about 6 miles off Cape Sable that teemed with south Florida bird life.

When Audubon lay down to sleep the first night on the island, the water almost touched his feet, but in the morning he found the tide had retreated to such a distance that his boat lay out of the water on her side. On the exposed flats, thousands of birds were probing in the mud and the pools for food.

It was on this expedition that Audubon discovered the great white heron, whose likeness appears today on the Everglades National Park postage stamp. He named it *Ardea occidentalis.* It is the largest of the American herons, with a seven-foot wingspread. We wonder why no scientist before Audubon identified this spectacular bird. It may have been mistaken for the American egret, although the egret is a smaller bird and its legs are black instead of yellow. Or it may have been less common at the time than other large birds within its restricted habitat.

The group returned to Indian Key before sunset, and Audubon began at once to sketch some of the new birds he had seen. Not even the sailors' dance in an adjoining room of the pilot's house, with fiddles screeching through the night, deterred him. After working almost through the night, he swung himself up into a hammock on the piazza and slept until just before sunrise. By the time the sun had come up, he was already on the water, off on another expedition.

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*As originally quoted by Audubon from Dr. Benjamin Strobel's version, the Wreckers' Song was in German dialect, but it was doubtless sung in a variety of accents. Therefore, it is rendered here in plain English.

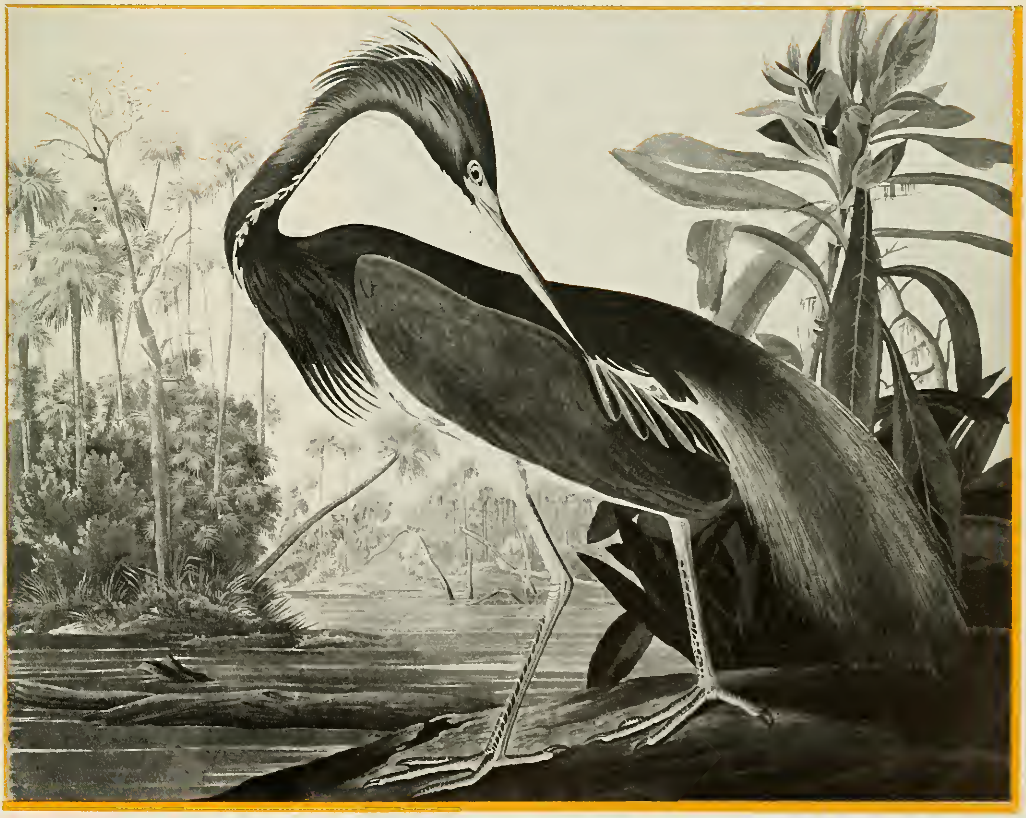
Three of the specimens Audubon gathered that day have made ornithological history. He collected a trio of European greenshanks that, to this day, have not been seen again in the United States. Another rare find of Audubon's was the Key West quail dove. It is known only from that island, and none has been seen in recent years. The beautiful zenaida dove he observed has apparently disappeared now from these regions.

On his way back to Indian Key from one of these expeditions, the sky abruptly darkened. Quickly reefing the sails, the pilot told Audubon that they "were going to get it." In the same moment sharp yellow streaks of lightning flashed across the water, striking a pair of whirling hawks, who plummeted into the sea. "A furious cloud," Audubon wrote later, "now approached, like an eagle with outstretched wings in haste to destroy us." Their experienced guide steered them across a flat to the nearest land. The blast of the hurricane struck the sides of their boat, and she "shivered like a leaf." They thought she had gone over, but the next instant, Audubon said, "She was on shore, and now, in contemplation of the sublime and

Continued on page 45

➤ Today, at their rookeries in the Florida Keys, the Louisiana Herons are still an unforgettable sight. They are one of our commonest herons

Photo by Allan D. Cruickshank



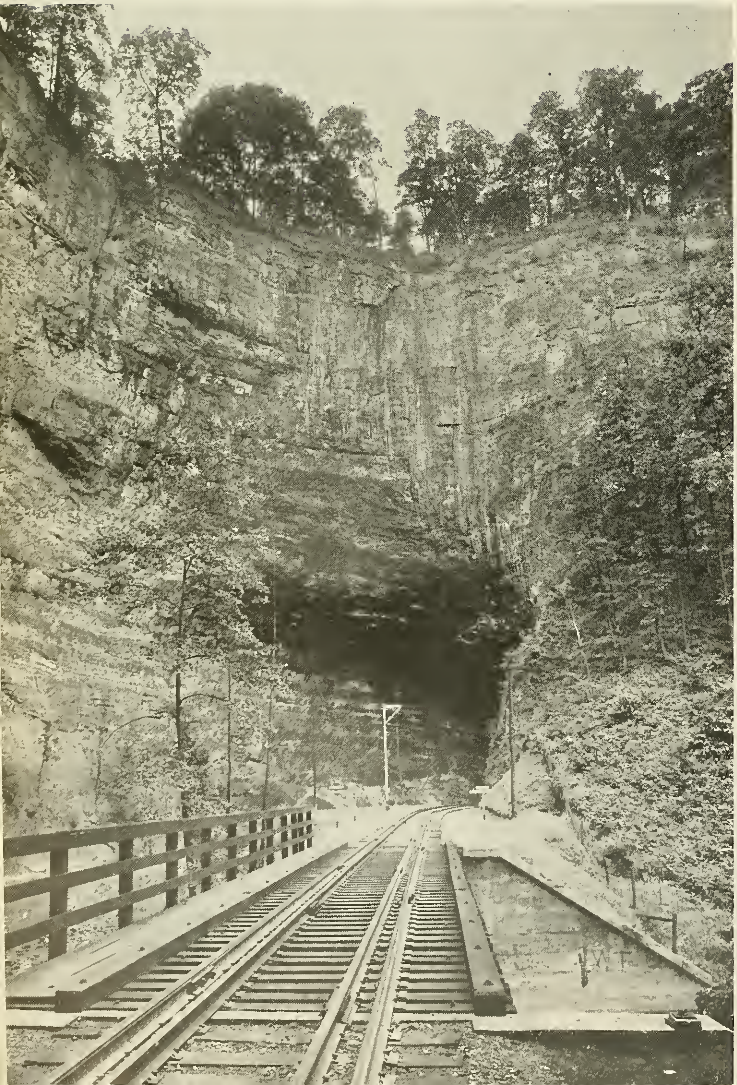
⮟ The Louisiana Heron, drawn from nature by John J. Audubon. He saw many thousands of these birds nesting at Sandy Key

The TUNNEL that Nature Carved

An ancient stream in Virginia shares its majestic handiwork with a modern railroad

By Dolores Butterfield Jeffords

Photo from Natural Tunnel, Chasm and Caverns Corp., Gate City, Va.



A NATURAL wonder that serves a utilitarian purpose is doubly a wonder—and that is the case with Natural Tunnel, in the west-central part of Scott County, Virginia, near the Tennessee boundary. Fashioned by Stock Creek on a scale out of all proportion to the size of the creek itself, the tunnel was made use of in 1882 by the builders of the South Atlantic and Ohio Railway as the most feasible route to the coal fields of that mountainous section of Virginia. The road is now a part of the Appalachian Division of the Southern Railway System.

Piercing the solid limestone of Purchase Ridge, a spur of Powell Mountain, the tunnel measures 900 feet in length, with an average height of 100 feet and an average width of 130 feet. Stock Creek flows along one side of the slightly sinuous passage, leaving ample room for the track and telegraph poles of the railroad.

To the great enhancement of the tunnel's beauty and interest, its southern end opens into a vast, circular, roofless chamber, almost completely enclosed by vertical walls of limestone and dolomite, rising from 364 feet to 750 feet above the creek level. The distance around the rim of this "crater" is estimated to be about 3000 feet. From this amphitheater, as it is called, Stock Creek goes its own precipitous way, through a breach in the walls, to join the Clinch River. Bridging the creek, the railroad track continues into another passage, known as Little Tunnel. The total length of both tunnels and the intervening crater is 1557 feet.

Passenger trains pause in the crater for the travelers to view the tremendous spectacle, which is even more overwhelming, however,

◂ This spacious "amphitheater" divides the tunnel into two sections. This is a view of Natural Tunnel from the entrance to Little Tunnel. The bridge spans Stock Creek when seen from the edge of the crater's rim. Track, trains, and telegraph poles seem reduced to toy size, while the passengers become tiny animated dolls, dwarfed by the height of the chasm walls and the immensity of the cavern entrance.

Like a sentinel standing guard over the open crater is Indian Head Rock, a great promontory which presents, from certain angles, an austere aquiline profile.

There is a somewhat similar but far less spectacular and well-defined amphitheater at the other entrance to the tunnel, where Stock Creek flows through a steep, narrow gorge into the tunnel. Above this gorge the creek flows through a broad subsequent valley of altogether different character; but from a point near Horton Summit it falls about 300 feet in a distance of 6 miles, to the point where it joins the Clinch River, at Clinchport, about 3 miles below Natural Tunnel.

Scientists believe that the entire gorge was once an underground waterway, of which Natural Tunnel is the last remaining roof-remnant. Probabaly the amphitheater at the south end of the tunnel was also, at some remote time, a continuous part of the roofed passage.

This natural wonder, which for many years was almost inaccessible, is now reached not only by the railroad but by north-south U. S. Highway 23, east-west U. S. 58, and U. S. II, by connection with the private road leading to the tunnel itself. The old Daniel Boone trail of the westward-moving pioneers (now the Daniel Boone Highway) passes near by, and the roof of the tunnel provides a crossing for a country road over the gorge. Rustic paths lead to Lovers Leap and other near-by points of scenic or legendary interest. A tourist lodge and picnic and camping grounds make it an increasingly popular attraction, for the surrounding country is beautiful, and its primitive ruggedness has been to a great extent preserved.

This is particularly true of the tunnel and amphitheater. Despite the accessibility of this natural wonder and its invasion by the railroad, consistent efforts have been made to retain unmarred the beauty of nature's handiwork. And beautiful it is, vast and wonderful —with little Stock Creek babbling on and on, telling in its own way of the prehistoric ages through which it labored to carve this mammoth tunnel, which it now has to share with a man-made railroad.

Photo from Natural Tunnel, Chasm and Cavern Corp., Gate City, Va.

➤ THE SOUTHERN RAILWAY approaching Natural Tunnel

▼ A VIEW OF the interior of the Tunnel showing the west wall, carved by an ancient stream whose feeble descendant promises no such heroic work

Virginia Chamber of Commerce photo

Concluding actions in the attempt to explore and measure a Mexican canyon reported to be deeper than the Grand Canyon

The Descent into the Barranca del Cobre

By Robert Thomas Moore

Director, Zoological Laboratory, Occidental College, Los Angeles, California

All photographs by the author

AFTER ten days of struggle against thirst, fatigue, illness, and scorching heat, we at last were approaching a point from which our destination—the big canyon—might be reached in one long march.

We dragged ourselves into the village of Chiricahui late in the afternoon. Fortunately, I insisted on putting up the tent to protect the films, specimens, and valuable equipment, for it rained again. We were up by sunrise on the fourteenth and soon on the trail, heading generally northeast. We were determined to reach the great Barranca that day.

For some time the *cargadores* had been getting more and more surly. Juan said they demanded *fresh* tortillas. These had to be obtained or else the *cargadores* might desert us. He and I went ahead, while the others held back so as not to frighten the Indians, and when Juan saw a hut on a ridge ahead, he told me to wait until he whistled. Then he went on alone and talked with the Tarahumare and his squaw, who waited because they recognized him as one of their own race. At his whistle I went up, and Juan persuaded the squaw to cook the tortillas.

She offered me a dish of ground corn, which had an unusual slimy, yellow appearance. Juan said it was a much-prized Tarahumaran specialty and that I must eat it lest she be insulted and refuse to cook the tortillas. I had eaten queer dishes in various parts of the world, but this had the vilest taste of all. At the back of the hut, Juan showed me the hairy cases of about 100 black caterpillers, whose contents had been squeezed into the concoction. I paid for the tortillas all right!

We were following a moss-banked stream that meandered around fern-covered rocks through a primitive forest of pines, cedars, and oaks. Many rills were joining the stream, and we stopped frequently to drink their pure water, delicious after our thirst. We often passed Tarahumares plowing with oxen on seemingly impossible hillsides. One, to our surprise, was willing to have his picture taken and held his goad straight up in military fashion, but while I was focusing, the ox kicked him out of the picture. Another try was more successful.

Suddenly our trail came to an end against a great pile of logs. A Tarahumare told Juan his family had decided to plow up that side of the valley and we would have to retrace our steps and take the other side. We found the new trail a frightening ordeal for our mules, but we got through into the high forest. Here Juan lost the track, and for two miles we wandered through the forest; Jim obviously was much worried. The rain had no right to be coming so early. "If you insist on going to the bottom of the big Barranca and camping there for two weeks," he said, "the regular rainy season may start three weeks early and catch us in the canyons. A real downpour could flood the Arroyo Hondo 30 feet in a night, and we'd never get across." I knew that what Jim said was true, but I suggested we wait to see how much rain would fall in the next few days. After all, the rainy season was not supposed to begin until June 24!

We now encountered some really severe ascents, which eventually took us to 8200 feet in altitude. A large wooden cross loomed up ominously. Some unfortunate wayfarer had died there. An enormous wall of cliffs fronted us at a distance of several miles running northwest and ever higher into the sky. Descending slowly through a stand of huge pines, we came out upon an open field of great dimensions, with hand-hewn log buildings of some size on its western circumference. Juan cried that it was Churo, and the horizon to the east was the rim of the Barranca del Cobre!

We were a disheveled group of

cavaliers as we rode up to the Ranch. And Señor Mancinas' greeting, though delivered in a grand manner, did little to lift our spirits. Indeed, he took all the romance away when he asked, of all things, "Would you like to telephone to your home in the United States?" Somewhat crestfallen, we asked if it was a common thing for Americans to reach this place. No, he had not seen any for many years, but a single telephone line had just been strung to trees from Creel, three days away to the east. He had not seen Americans since the railroad engineers of the Kansas City and Mexico Railroad had come to survey the route via the Barranca to the Gulf of Lower California.

"Don't tell us," we cried, "that a railroad runs along the rim over there."

"Oh, no! The idea was abandoned as being impossible."

"Did any of the party descend to the bottom of the Barranca?"

"No, Señor, I do not think so. It is very dangerous! But my brother has a ranch part way down. You can make it that far, but the trail is worse than any you have come over."

"We're going to the bottom!" I said with finality. Then I added for Jim's benefit, "Our zoological work is the most important. We hope to ascertain if the Uriqui River is being used as a migration route for birds." Jim looked at me with his quizzical expression, obviously disgusted, but said nothing.

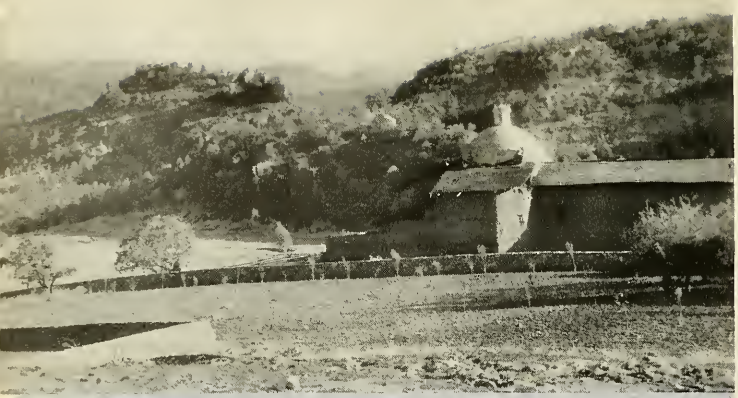
We ate dinner on the huge stone-flagged veranda 100 feet long by 20 feet wide. Never did fried eggs, flapjacks, canned peas, canned pears, and peanut butter taste so good. I slept with Paul in the telephone room, with the open hand-hewn doorway barricaded by boxes to keep out the ravenous dogs.

The next morning, after enjoying an ancient Tarahumare fiesta enlivened by dances, we mounted our five mules and, followed by our burros, headed for the "Rim." Our first view of the Barranca del Cobre was startling enough, but the one from Jotami was surely as breathtaking as the one that caused Father Salvatierra to quake with terror. Only birds could go to the bottom from this point. As at the Grand Canyon of the Colorado, one looked down on the peaks of a vast mountain range within the barranca. But the colors were softer—none of the somber dark reds of its northern counterpart, but brown and pale yellows. Farther east we were to see sections of green. Its grandeur lay in its seemingly greater width and depth. We could not even see the bottom. A secondary canyon perhaps a mile below us, with narrow sheer walls, cut off our view of the Uriqui. Those inner cliffs would be difficult to negotiate!

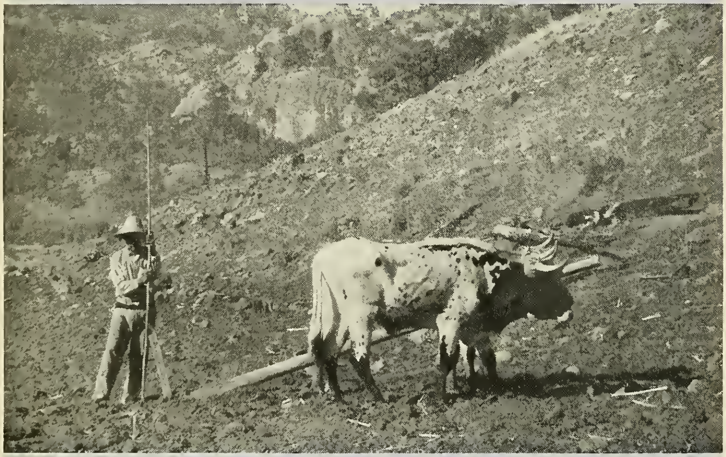
We found an easier place several miles to the east, which proved to be the customary descent to the "brother's ranch." At its beginning rose a large wooden cross at whose base was a four-foot pile of stones. Juan said that each traveler added a stone and said a prayer for protection before attempting the dangerous descent into the mighty barranca.

For ten minutes we descended through enormous pines. Suddenly rounding a jutting rock, the view of the vast canyon burst upon us, and for half an hour we stood, too amazed to analyze. It was not one great canyon but a series so complicated that it was difficult to conjure any measuring unit by

▼ **The expedition's** first view of the canyon was from this point at an altitude of 8200 feet. The rim of the inner canyon is 4000 feet below



▲ Although deep in the back country of Mexico's state of Chihuahua, the Tarahumare village of Chiricahui boasted a "cathedral." The adobe building stood in a plowed field and was roofed with hand-hewn shingles. Its round central tower of brick was covered with mortar



▲ The Tarahumare Indian who a few moments before had been kicked out of the picture by his ox

▼ At the rim of the canyon: a large wooden cross and a four-foot pile of stones on which it was the custom for every traveler to add a stone before making the perilous descent

which to gauge its depth and width or even to determine which was the main canyon of the Uriqui. A fine silver thread more than 5000 feet below us was finally determined to be the main river of the Uriqui system. Only one pinnacle on the south wall was definitely green, in great contrast to the rest. As a color display it could not equal the Grand Canyon's sunset canvas, but it fully equaled it in spacious majesty and intricate patterns. Was it deeper?

We began the long descent. The trail was truly terrifying and would have been impossible for inexperienced hikers. In many places the steplike rocks were so slick they threatened disaster to riderless mules even without any packs. The laden burros often slipped six to eight feet at a time. As we dropped, the intense heat of the lower canyon walls swirled up at us in torrid waves, until we seemed to be in a steaming cauldron.

Soon all desire to study or collect the objects of natural history about us was stifled, and each of us sought the shade of every small thornbush and cholla. It required four hours of suffocating exertion to reach a green spot, which proved to be the ranch of Mancinas, with its 75 orange trees enclosed by a wall. A spring above furnished irrigation. In addition to the ranch house of mortared rocks, there was a two-story hut in the orange grove, open at both ends on the second floor for ventilation. This was offered to me and gladly accepted. It proffered protection for our specimens, room for taxidermical work on the first floor, and fairly cool sleeping quarters on the second.

The usual thunderstorm that night caused mutterings from Jim about "floods," and I decided that we must make the bottom the very next morning lest Jim should insist on returning.

So at sunrise, Paul and I made a reconnaissance to the rim of the inner canyon. After several hours of searching with a Tarahumare boy, we discovered a somewhat easier slope. An hour later our sturdiest burro was careening down and balking frequently. We followed with much misgiving, slipping and sliding precariously at times, narrowly avoiding serious falls. The Indian boy, José, after it was too late, told us there was an easier route to the Uriqui several miles to the east.

We reached the river late in the afternoon, fourteen and a half days after leaving Guirocoba, only to be greeted by another terrific thunderstorm! The detonations from the cliffs were frightening. The deluge struck before we could raise the tent, so we took refuge under a rock. Where the rain hit the hot walls of the inner canyon, it was instantly transmuted into steam. When the rain ceased, we tried to raise the tent again, only to be greeted by a new onslaught. After the tent was finally erected, it was too dark to arrange the equipment, and I had a miserable time trying to sleep on top of it with my head lower than my feet. The humid heat was stifling.

On the morning of the seventeenth, Paul and I hunted for the nests of birds, but I was chiefly seeking late migrants on the way to Texas. I had been convinced by specimens taken on the plains to the west that migrants from Texas, such as the Black-capped Vireos, go south over the plateau of Chihuahua until they reach the eastern end of the Barranca del Cobre and are then lured by the increasing warmth to descend into the barranca and follow it out onto the plains of northern Sinaloa. We obtained some new evidence to support this theory.

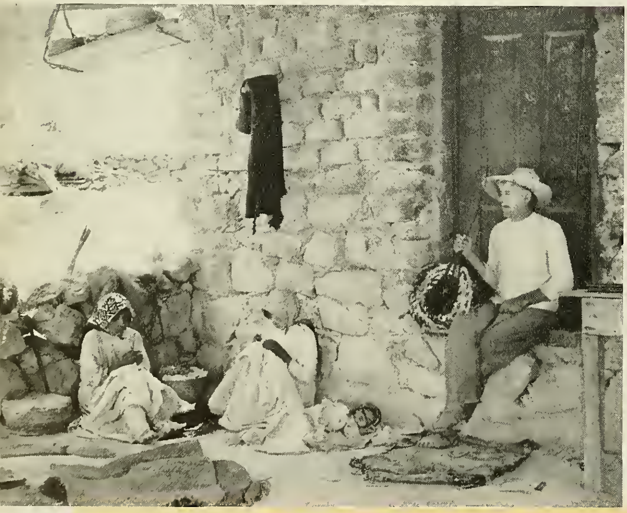
At sunrise on the eighteenth, we hiked down the river and proceeded for one and a half miles to a point opposite a deserted Tarahumaran *finca*. Here a fine stream dropped into the Uriqui, forming small cascades and a waterfall not visible from the river. We forded the Uriqui and climbed up the stream 100 feet on the opposite side to reach the *finca*. The clearing revealed several much neglected orange trees. Señor Mancinas had told us there had been a heavy "freeze" four years earlier, and snow for the first time had fallen at his ranch (half way up the canyon wall), banking several feet deep. The freezing conditions had killed most of the orange trees on Indian farms within the barranca, even a large grove of 1000 farther down the river.

We continued collecting downriver for another half mile when dizziness gave me warning that I was in danger from my old enemy —sunstroke. Paul and I succeeded in jumping across to "our" side of the river. It was considerably deeper than at the earlier ford, and the exertion and several falls, plus the heat, sapped my strength. I crawled under the shade of a huge rock, admitting I was too dizzy to walk. Juan, unable to make the crossing in his slippery leather *zapatos*, returned to the

▲ JUAN ON THE WEST RIM of the Barranca del Cobre, gazing at the east rim in the distance

⮜ THE RANCH and orange grove of Mancinas, 3400 feet below the rim of the canyon on a shelf extending out from the north wall

⮟ THE AUTHOR'S headquarters in the orange grove inside the canyon



⮝ RANCH of "the brother," José Maria Mancinas, who is sitting on his veranda with his Tarahumare family

⮞ MORE PRIMITIVE was the home of a Tarahumare family under a huge, sharply leaning wall, a mile from the Mancinas ranch. All of the children had been born under this partially exposed cliff

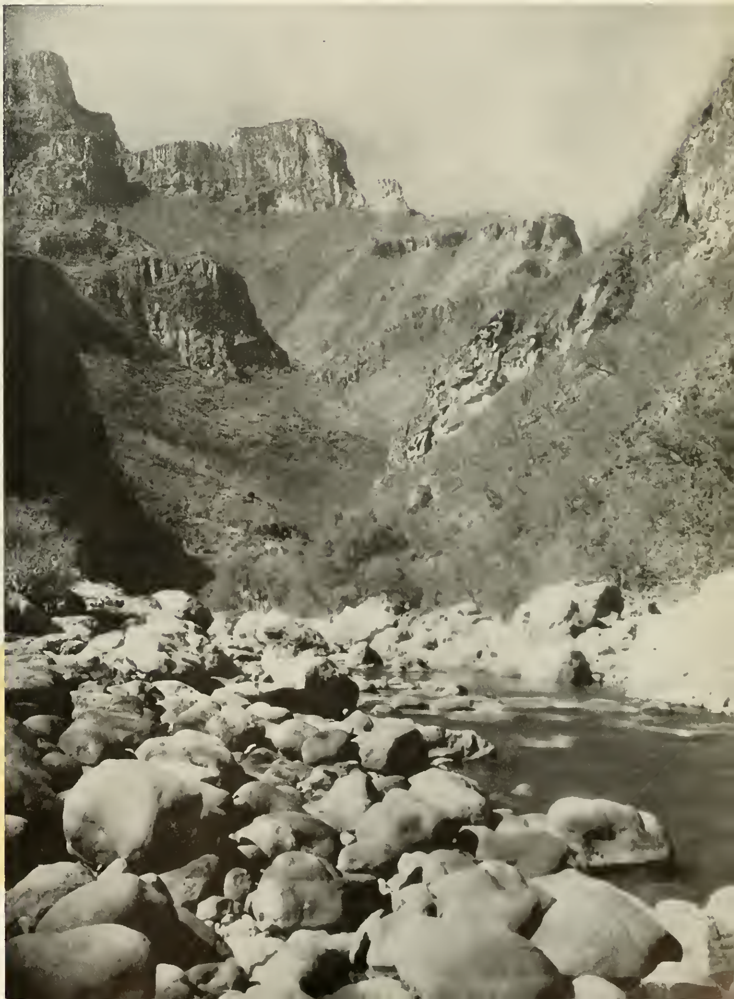
upper ford, shouting that he would bring the burro for me, if possible. How could he lead it through the huge boulders along the west wall!

He was gone for hours and then to our amazement appeared with the sure-footed animal. We reached our tent site by 2:30 P.M. Realizing I should not stay longer, Paul packed up the equipment, and by late afternoon we completed the 2100-foot ascent to Mancinas' Ranch at Tohuarique. Never did mere greenness look so alluring as that dark green orange grove and its shade.

As twilight fell, I mused about the depth of this majestic canyon. Miles up the barranca was an enormous cliff visible from the orange grove. It might well be Visaderio, where the Indians claimed the deepest point was located, but Jim would never agree to spend another week necessary to ascend and then make another descent. Clearly I must abandon the idea, however alluring it was. After all, the expedition had been highly successful. My one regret was that we had not brought more accurate instruments for determining the depth of the barranca. Aneroid barometers, even the best such as our large Paulins, are subject to errors due to changes in the weather. However, I had left an extra aneroid at Churo to be read each morning, noon, and night at the same time we read ours. We had determined with reasonable accuracy the difference in altitude between Churo and the high point at Jotami; and we had read the altitude of the Uriqui at the lowest point we reached, almost opposite Jotami at noon. The difference between the two readings, admittedly subject to error, gave the depth as more than 5500 feet. However, it was important to have a reading at Churo at the same time we made ours at the bottom of the Uriqui. This would give us a fairly accurate check.

Cave dwellings were not uncommon in the barranca. The most primitive one was the home of a Tarahumare family under a huge, sharply-leaning concave wall of a cliff a mile from Mancinas' ranch. All of the children had been born under the partially exposed cliff. The husband had been severely hurt recently by a fall and had to be carried 3000 feet up to Churo. As cave dwellings of the Tarahumares have been described in detail by Lumholz, the conventional kind will not be described here.

The animals got several days' rest at the ranch while we photographed the barranca from various points. By the twentieth, Jim's concern about possible floods had reached a serious pitch, a real obsession. At five in the afternoon, when a huge black thunderhead approached down the barranca, he called for a conference and insisted we start our return trip in the morning. Paul and I wished to stay another week, to get more photographs and collect another 300 specimens of bird life. But Jim claimed that it was dangerous to stay another day and said he could no longer guarantee that the Indian cargo bearers would not desert us. He could not be responsible for the loss of 20 animals, which might



➤ **WHERE THE explorers forded the Uriqui, the water was only a little above the knees. Lack of precipitation had reduced it to a third of its normal width. Ordinarily it would have been almost impassable** well perish in the floods or starve to death. Up to this time, every one of Jim's prophecies had been fulfilled to the limit. Certainly his advice merited careful consideration. He knew I would be responsible for the loss of the animals, but the possibility of desertion swayed me! I had had enough of that kind of experience in the Andes.[7] So I decided to move on the morrow, May 21.

The ascent out of the barranca proved as difficult as the descent but was accomplished without loss. The important question kept ringing in my ears all the way to the Rancho: "Was the aneroid read regularly at the hours agreed on?" And I pushed my mule at his fastest pace, which was irritatingly slow. Finally I confronted Mancinas and awaited his answer. "We read them a lot of times, Señor, but not always. We were so delayed in our work on the *finca* because of the thunderstorms; but here they are —I am sure they are accurate."

I grabbed the notations and looked for the vital reading at noon of the eighteenth of May. *There was none!* He had read it only for the morning and evening hours, and a thunderstorm had intervened, eliminating the evening reading as almost valueless. Even the morning one was taken four hours earlier than ours at the lowest point. All we proved was that the Barranca del Cobre was very deep, almost surely over a mile. There was some consolation in the realization that the determination of the depth at any one point would never provide data for a real comparison with the Grand Canyon. At least two months would be required even for a regular surveying party with the proper instruments to obtain authoritative data. The barranca is reported to be 100 miles long. Furthermore, we were told that the Barranca de San Carlos of the southern branch of the Uriqui-Fuerte system is believed by some to be the deepest canyon of all.

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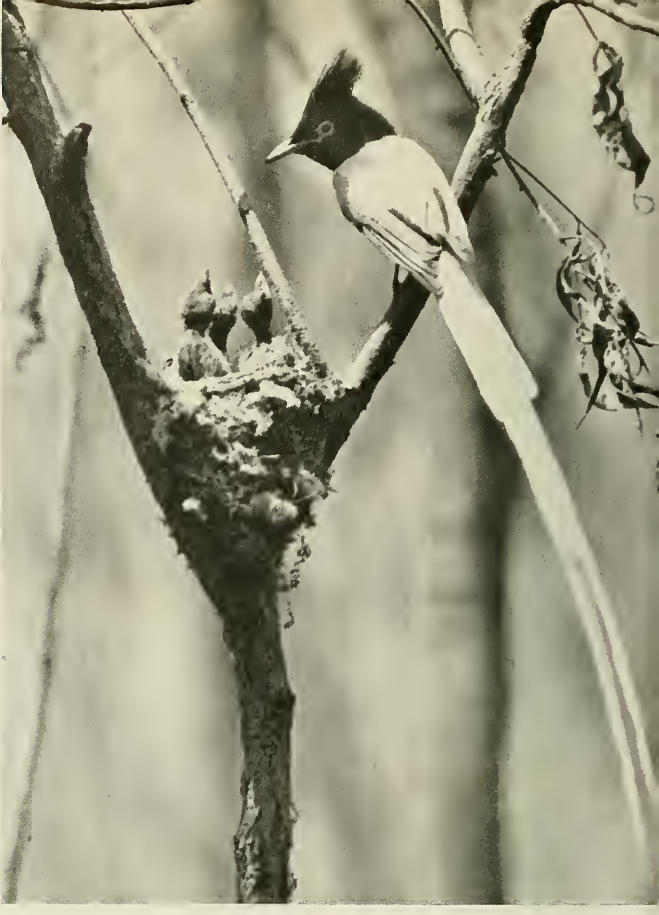
[7] See "The First Ascent of El Sangay" by the author in NATURAL HISTORY for May and June, 1950.

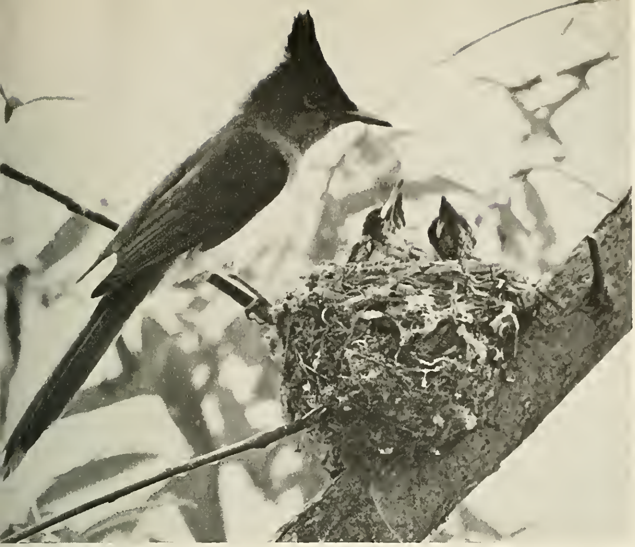


▲ IN FLIGHT, the long tail undulates horizontally behind the bird. This cock was brave enough to feed the chicks as soon as the photographer set up his blind, but individuals varied considerably in this respect

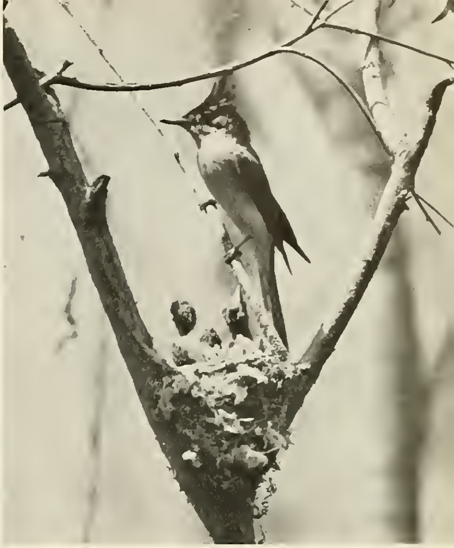
THE *Paradise Flycatcher* IN KASHMIR

One of the prettiest sights in this fairyland of lakes and mountains is a tiny bird with a long trailing tail

By LT. COL. C. L. BOYLE
Secretary, Fauna Preservation Society



HE NEST of the Paradise Flycatcher is a neatly woven cup placed in the of a thin stem or branch. The female, lacking the long tail, has a ht chestnut back and tail and pale underparts. Both sexes share in bation and feeding

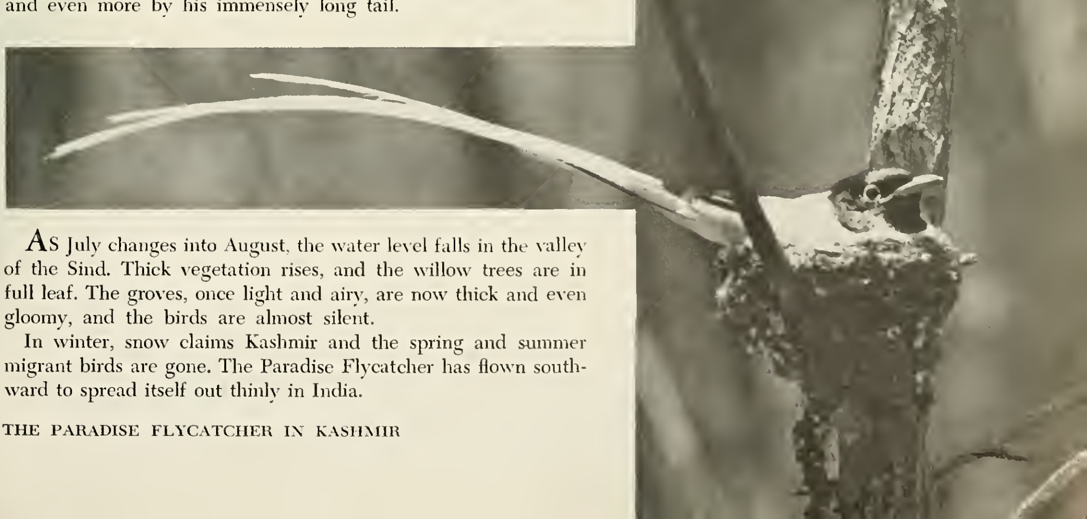


▲ TRUE TO ITS NAME, this flycatcher feeds chiefly on winged insects. Dragonflies somewhat too large for the tiny gape are sometimes offered to the young, but the parent never thinks of serving the insects piecemeal. After futilely trying to cram the oversized insect down the throat, the adult will fly off to devour it elsewhere; even the limited capacity of a chick's throat has its compensations

SETTING out from Lahore by automobile or bus, the traveler crosses the plains of the northern Punjab for 100 miles and then passes through the magnificent gorges of the Chenab. At 9000 feet he reaches the snowbound Bunhal Pass. Then he drops swiftly 4000 feet into the vale of Kashmir. The road he follows is now girt with aspiring poplar trees and rice fields, and beyond Srinagar there is a wealth of lakes and rivers, surrounded by mighty mountains.

Here the river Sind, after debouching from the mountains, fans widely, forming a well-watered country with many little islands. In the month of June, when the snows are melting, the small plantations of young willow trees are often ankle-deep or more in water. Among these trees fly many lovely birds, but it would be hard to find another so beautiful or with a name so apt as the Paradise Flycatcher, *Terpsiphone paradisi*. It is a small perching bird, in body less than a sparrow; but the adult male is greatly distinguished by his plumage of darkest blue and glistening white, and even more by his immensely long tail.

▼ GRACEFULLY POISED on the nest, this male is not unwilling to share family responsibilities. But some of them were observed to leave most of the heavy work of feeding to their mates



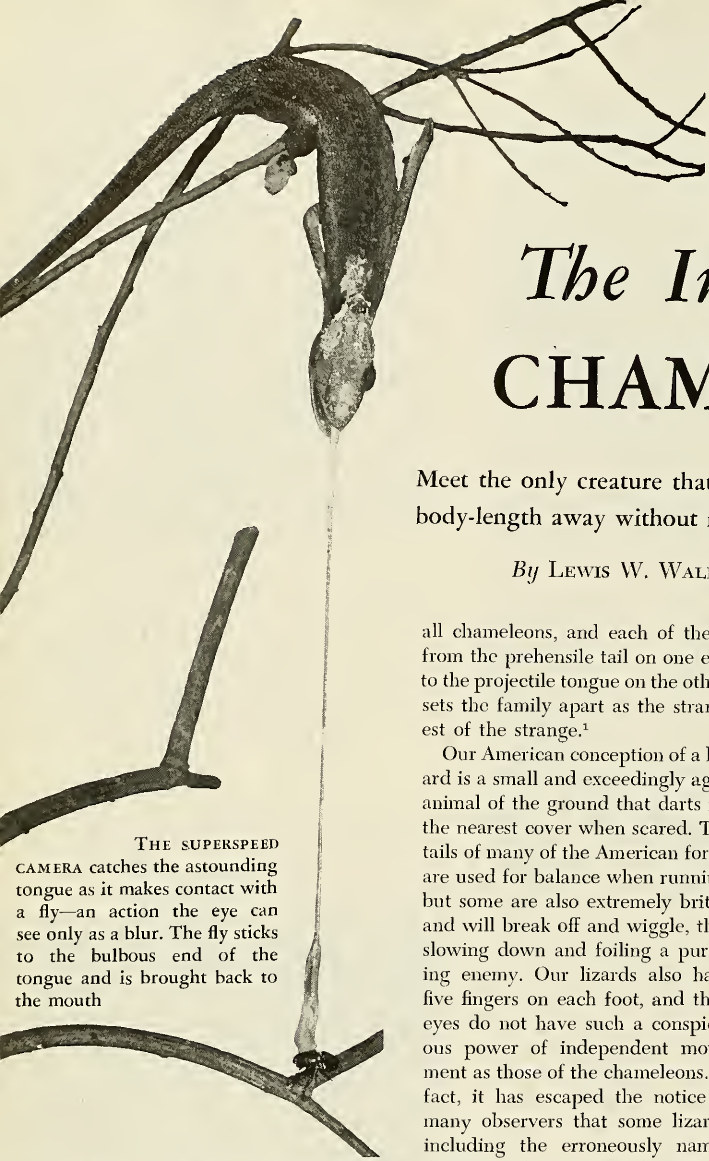
AS July changes into August, the water level falls in the valley of the Sind. Thick vegetation rises, and the willow trees are in full leaf. The groves, once light and airy, are now thick and even gloomy, and the birds are almost silent.

In winter, snow claims Kashmir and the spring and summer migrant birds are gone. The Paradise Flycatcher has flown southward to spread itself out thinly in India.

The Incredible CHAMELEON

Meet the only creature that can capture its prey more than a body-length away without moving anything except its tongue

By Lewis W. Walker *and* G. E. Kirkpatrick



The superspeed camera catches the astounding tongue as it makes contact with a fly—an action the eye can see only as a blur. The fly sticks to the bulbous end of the tongue and is brought back to the mouth

If a handful of miscellaneous parts were random-picked from various animals, then assembled in the general form of a lizard and adorned with the mechanical turrets of a tank to act as eyes, the resulting creature might resemble a chameleon.

There are some 80-odd species of these outlandish reptiles, each with its own specialized set of gadgets in the form of horns, bony shields, and fantastic helmets. However, many strange anatomical features are standardized equipment for almost all chameleons, and each of these, from the prehensile tail on one end to the projectile tongue on the other, sets the family apart as the strangest of the strange.[1]

Our American conception of a lizard is a small and exceedingly agile animal of the ground that darts for the nearest cover when scared. The tails of many of the American forms are used for balance when running, but some are also extremely brittle and will break off and wiggle, thus slowing down and foiling a pursuing enemy. Our lizards also have five fingers on each foot, and their eyes do not have such a conspicuous power of independent movement as those of the chameleons. In fact, it has escaped the notice of many observers that some lizards, including the erroneously named "chameleon" of circuses (the American anole), can follow more than one object at a time. At best, however, their ocular maneuvers are very modest compared with the manner in which a true chameleon can swivel its turret-mounted eyes independently, which is a sight to behold.

The chameleons are one long contradiction to our general conception of a small four-footed reptile. Instead of a rear appendage so inconsequential that it can be lost at a moment's notice and regrown at leisure, the chameleon's tail is a delicate organ, fully equipped with muscles, nerves, and a sense of feeling. When the animal is on a flat surface, the tail is carried neatly curled and partially protected against the body, but when in the branches of trees its tip-end constantly wraps around twigs to prevent a fall. In a sense, this prehensile tail gives the lizard an added hand for its aboreal existence.

Life in the branches has also brought about a peculiar development of the feet and a strange placement of the toes. Instead of a hand with five separate fingers, the chameleons have their fingers almost fused together, two on the outside and two inward—an adaptation perfected for the grasping of small branches. And these little tonglike hands are set at right angles to the line of the body. The rear legs are somewhat similar but have the toes fused in a reverse arrangement.

The chameleon's use of its legs, body, and prehensile tail could best be described as slow motion. Every action is deliberate and drawn out, whether it is the releasing of one branch or the gripping of a new one. But this lethargic demeanor stops with the eyes, as they rotate independently in their peculiar tur-

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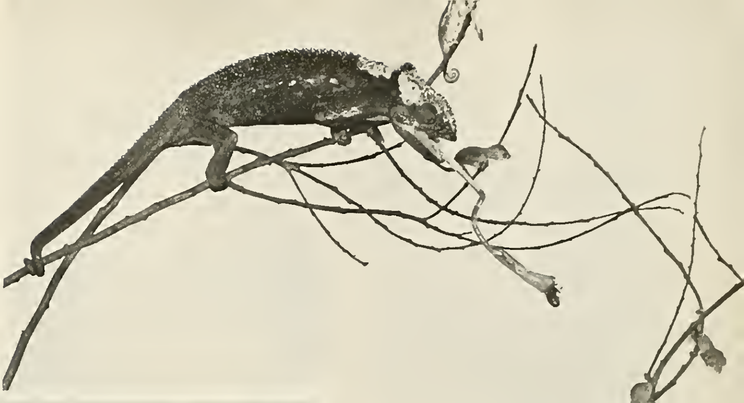
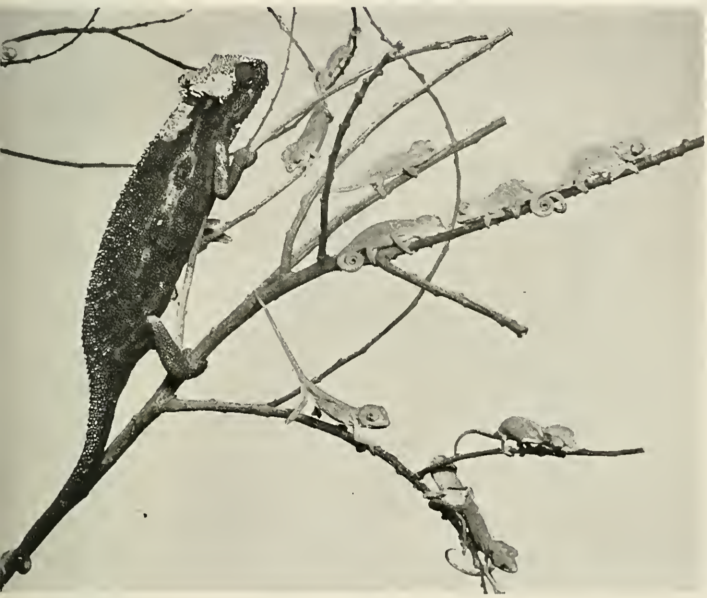
[1] The "dwarf forest chamelons" (*Rhampholeon*) lack the prehensile tail.

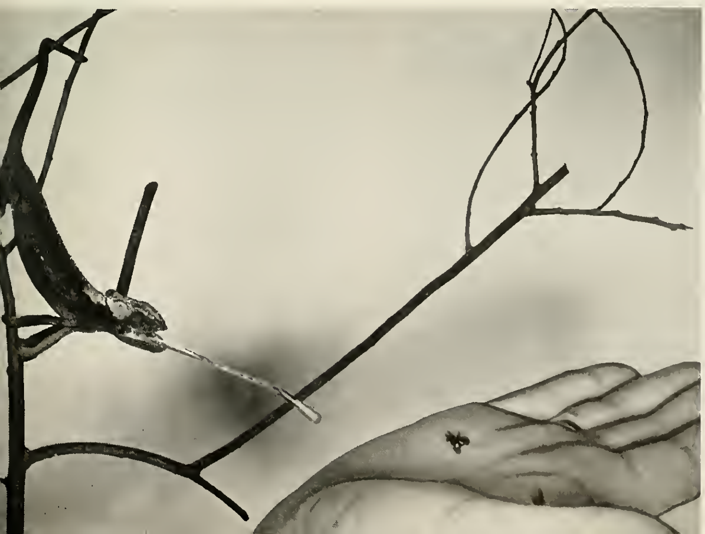
➤ THE TONGUE becomes limp when it contracts into the mouth. Notice the newly hatched young, which used their tongues with full efficiency on fruit flies within a few days after birth. No attempt was made to feed them at birth



⮟ THE 24 YOUNG were born in thin membranes soon after the mother chameleon arrived at the San Diego Zoo from Cape Town. But not all chameleons are born in this way. Some are reported to lay as many as 50 eggs in a hole painstakingly dug in the earth



⮟ THOUGH THE CHAMELEON was newly arrived from South Africa, it was soon willing to take food from the hand. This species is *Microsauria pumila pumila*

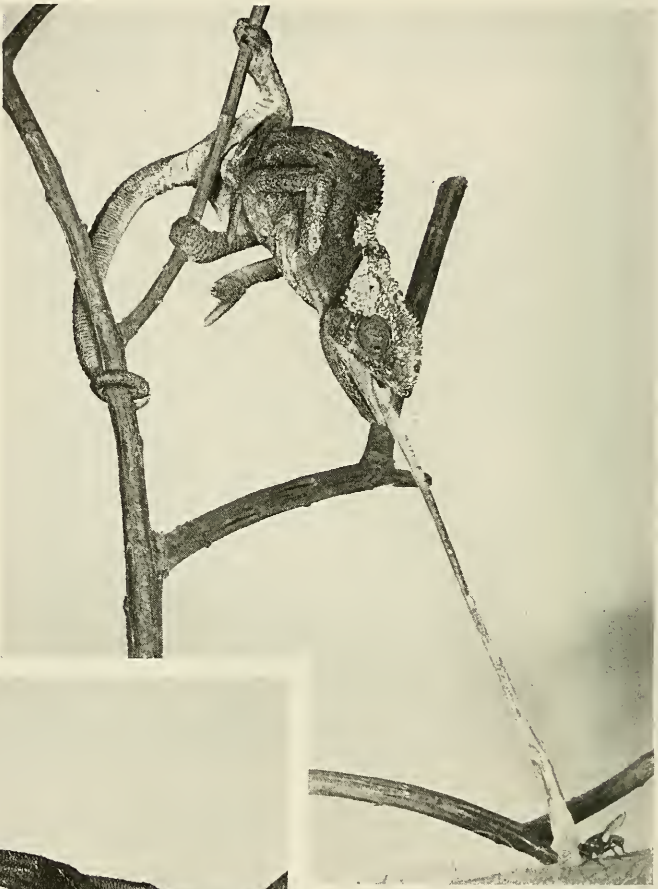


ret sockets. These unique organs project prominently from the sides of the head as cone-shaped tubes, capable of revolving in any direction. The eye is located at the outermost point of the cone, making it possible for a chameleon to see his nose, forehead, and perhaps even his other eye without undue strain. Usually, while one optic is scanning the ground below for possible enemies, its companion is searching the branches above for insects, but they work in unison when tasty prey is sighted.

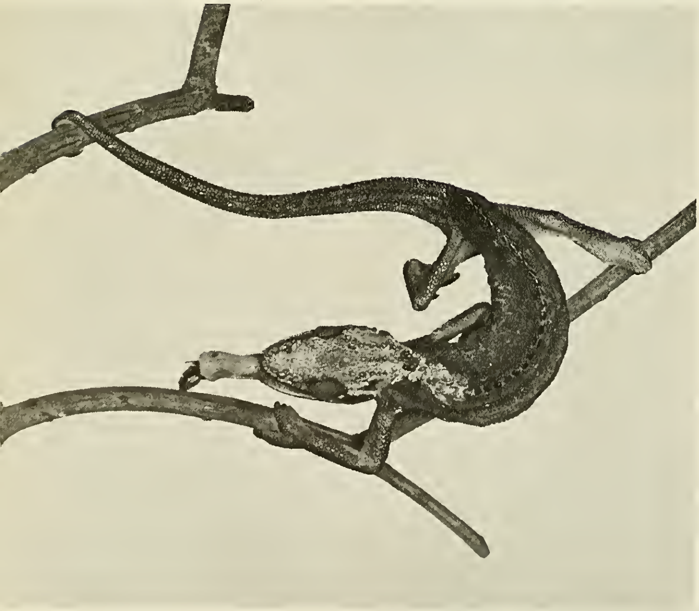
This can be a fly, beetle, or worm—and as far as ten inches away from a six-inch lizard. If beyond this distance, then one eye will keep the food in focus while the other selects branches upon which to effect a cautious slow-motion approach. When the range is right, the two eyes again swing to the front and the mouth of the lizard opens. From this point on, human eyes record only a blurred image of what takes place. The insect, completely unaware of danger, disappears from the branch and dangles instead on the sticky end of a string-like tongue. The outthrust is lightning-like, but the return to the mouth is slower and can be watched as the tongue, like a limp rubber band, contracts and thickens and pendulously swings as it disappears within the open jaws, with the bug still held captive on the bulbous end.[2]

The word "chameleon" is almost synonymous with changing color, and these strange old-world lizards are past masters of this art. However, the color changes are not necessarily governed by background. In some instances a green lizard on a green background can be frightened into assuming a color that is completely nonprotective. No doubt many of the changes are emotional and are just as difficult to control as a human blush.

The chameleon pictured in the accompanying strobolite photographs was sent by plane to the San Diego Zoo from Cape Town, South Africa, and soon after arrival gave birth to 24 young. Each was a perfect replica of its mother, with the exception of the scaly head ornamentations that probably denote maturity. They were born in thin membranes which were laid on a branch, but in their immediate struggle to escape they fell to the floor of the cage before breaking out. On emergence, wet and sticky, they sedately walked to the base of the cage tree and ascended to the higher branches. There, with tiny tails wrapped around twigs as though mimicking their unconcerned mother near by, they seemed to have complete confidence in their ability to control their strangest of equipment.



▲ Its turret-mounted eyes swivel independently. But when the tongue shoots out, they both concentrate on the target, probably to gauge better the direction and distance



◄ A stickiness holds the insect to the tongue while it is drawn into the mouth

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[2] For a description of how the chameleon's tongue can perform this remarkable feat, see "The Most Amazing Tongue in Nature" by Robert Cushman Murphy, Natural History, May, 1940.

Continued from page 31

awful storm I gazed around me."

The naturalist's description of the brief hurricane is a vivid one.

"The waters," he wrote, "drifted like snow; the tough mangroves hid their tops amid their roots, and the loud roaring of the waves driven among them blended with the howl of the tempest. It was not rain that fell; the masses of water flew in a horizontal direction."

It was on his birthday, May 4, 1832, that Audubon arrived in Key West, the southernmost Key. The little newspaper published on the island stated that the day was the "fifty-second anniversary of his birth." If this were true, the date is significant, for the various dates given as his birthday do not always coincide. The naturalist himself sometimes gave one date, sometimes another, and was deliberately mysterious or ambiguous about the place of his birth. He appeared to enjoy keeping alive the rumor that he was really the Dauphin of France, who had been spirited from that country during the French Revolution and was said to have been brought in infancy to the United States.

Audubon enjoyed Key West, with its bustle and excitement, occasioned by the salvaging operations, the influx of the rescued, the activity around the docks, and the chatter of the seamen who swarmed the streets. During the time that he knew it, Key West was filled with people from many countries, and many languages were heard in its shops and on its streets.

The well-to-do families who had made their homes here lived a gracious and leisurely existence, enriched by the luxuries the waves washed up on their reefs. The early settlers had chosen to build on the ridge of land on the deep-water side of the island. Although the island was but two miles wide and four miles long, much of its central area was given over to a big swamp having an outlet to the sea. Carts and carriages had to make their way over bridges, and there were catwalks for pedestrians. The depth of water in the "pond," as the citizens called it, varied with the ebb and flow of the tide. They were restrained from filling it in for fear of hampering the movement of the tides and inundating the residences. In the fall of 1831—the year before Audubon appeared on the scene—the city council had adopted a resolution to allow inhabitants to remove the woods then standing on Eaton Street. From Duval to Simonton streets the trees were cleared, but beyond this point the thick growth of primeval trees still stood. Wood and brush were cleared on that portion of the island lying between Whitehead and Elizabeth streets as far out as Fleming. In the '30's the house of Captain Francis B. Watlington was the only structure on Duval Street after crossing Caroline. Some fine old houses had been built of lumber floated over from the Bahamas. These stood on the low ridge of coral rock.

At times, when wrecks thrust large groups of salvaged passengers or crews upon the hospitality of the city, tents would be erected—as many as 50 or 60 of them. Many of the refugees were taken into private homes and, according to their mood, excitement often resulted. Rioting was not infrequent, and on occasion marines from the "Vincennes" or some other United States vessel were called in to quell the disturbance.

To all this, Audubon paid scant attention. His passionate interest was in the birds and plants of the island. He never tired of familiarizing himself with the rich natural life that abounded. Stephanotis vines hung everywhere; flaming poinsettias, hibiscus, allamanda, and great ropes of crimson and violet bougainvillea bloomed on every hand; and everywhere the birds! He rose each day at three o'clock in the morning, and from then until noon, and sometimes until night prevented further observation, he hunted among the mangrove hammocks for his specimens. Not heat, sand flies, or mosquitoes interrupted his arduous schedule. Returning from these expeditions, he set about making sketches of his finds, drawing hundreds of plants and birds, and writing copious notes for future reference.

His industry amazed the islanders. In an old copy of the *Gazette*, the editor reports wonderingly and with admiration, "Mr. Audubon is a most extraordinary man, possessed of an ardent and enthusiastic mind and entirely devoted to his pursuits; danger cannot daunt, and difficulties vanish before him . . ." The good editor went on to say, "Mr. Audubon has adopted a most excellent plan of connecting with his drawings of birds such plants as may be found in the neighborhood where they are taken. We hesitate not in giving it as our opinion that his work on ornithology, when completed, will be the most splendid production of its kind ever published, and we trust that it will be duly estimated and patronized."

Audubon was much liked in Key West. "The private character of Mr. Audubon," the newssheet continued, "corresponds with the nature of his mind and pursuits—he is frank and generous, always willing to impart information, and to render himself agreeable. The favorable impression which he has produced upon our minds will not soon be effaced!"

It was in Key West that Audubon painted his famed white-crowned pigeon. Some historians have erroneously recorded that he was the first ornithologist to find this beautiful bird in the United States. Actually the species was already known. It had been found in 1824 by Titian R. Peale, an artist and naturalist employed by Charles Lucien Bonaparte. Audubon had, it is true, used a local specimen for his model, but it was a migrant from Cuba or some other part of the West Indies. The snowy-topped purple pigeon still nests in the Keys and on the tip of the mainland in spring and summer.

When Audubon finally made his way north again, he carried love of the Florida Keys in a grateful heart. His notebook was filled with his observations. He had made many friends. He had enriched his great work. The interlude came to be a golden memory in a memorable life.

FIELD TRIP TO THE SOUTH SEAS

Continued from page 15

ity and warmth. Like the chiefs on Fais, he was heavily tattooed and wore a simple comb in his hair but no other decorations.

We stayed at Ulithi four more days, and in addition to Mog Mog we visited the islands of Asor and Fassari. King Ueg came along with us, and on each island he commanded the best fishermen to give me all the help I needed. Rows of rusty quonset huts—a fabulous leftover from the days of World War II when the Navy maintained a large base at this atoll—lay rotting among the coconut trees. Asor particularly had many of these eyesores unsuitable to a tropical island.

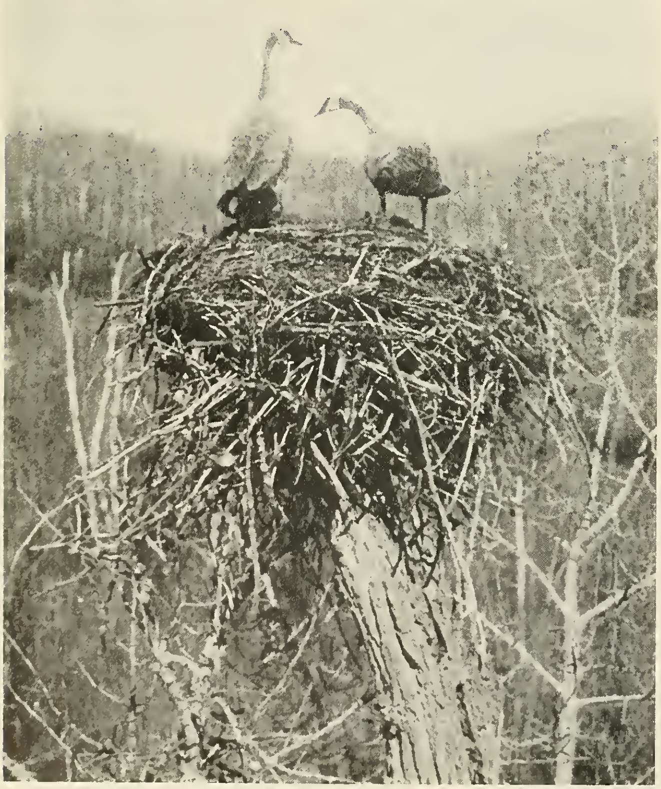
Fortunately, the important parts of my days were spent as usual in the least battle-scarred and most beautiful part of the South Seas—in the forest of corals and algae, where the graceful plumed heads of annelids and sea anemones three feet in diameter are the flowers, and fishes and fishermen are birds flying in three dimensions.

Ulithi was the last place for my underwater explorations. From there it was straight back to Koror where, after a few days of packing all my specimens I started the long plane ride back to New York.

Now that the fishing trips are over (at least for the present), and the many desired specimens have been obtained, much work still remains to be done. The expedition has, of course, provided material for many months of extensive laboratory work.

In my laboratory at the American Museum there are now hundreds of jars of what some persons might consider rather dull-looking preserved fish. But when, for example, I examine a faded specimen labelled "*Paraluteres prionurus*, reef on NW side of Kayangel, September 4, 1949," I can recall a little fish of brilliant colors, darting among large mushroom-shaped corals, and I remember the long chase after this evasive filefish, the excited feeling when my spear finally made its mark—the capture of a souvenir from an enchanting island 9000 miles away.

LETTERS



Treetop Nesters

SIRS:

In your November issue you published a letter from Mrs. Sunnie F. Lancaster of Opportunity, Washington, on the subject of geese nesting in trees. With the letter were printed some comments from my good friend Dr. John T. Zimmer. His remarks left no doubt that geese do occasionally depart from the habits laid down in the "bird books." As further evidence, I offer the accompanying photograph from the files of the Fish and Wildlife Service. It shows a pair of Canada Geese nesting in a fairly tall tree.

This picture was taken several years ago by Mr. Guy Thomas, who, I understand, was a guide in British Columbia. He sent it to the late Dr. E. W. Nelson, then Chief of the Bureau of Biological Survey. As I recall, the accompanying letter stated that the nest pre-empted by the geese had been orginally built either by ospreys or bald eagles.

F. C. LINCOLN
Assistant to the Director
Fish and Wildlife Service,
Washington, D. C.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

Tale about the Tails

Sirs:

In a recent popular book on animal intelligence, the author states that the mother opossum (*Didelphis virginiana*) arches her tail over her back and that the young ride around holding onto it with their own tails. I have examined several books on North American mammals but cannot find any author who substantiates this belief. I have a faint recollection that one author mentions this as a myth perpetuated by some taxidermist who mounted a female opossum with a number of young ones suspended from her tail.

I will be much interested to learn if there is any truth in this belief . . .

George W. Rawson, D. V. M.
Summit, N. J.

The following information is offered by Mr. T. Donald Carter of the American Museum's Department of Mammalogy:

There are numerous drawings and references concerning the habit of young opossums of entwining their tails around the tail of the mother for the purpose of more ably securing themselves on her back as she travels about. Undoubtedly the best-known statement of this sort and the one that is most frequently quoted is found in *The Quadrupeds of North America* by John James Audubon and the Rev. John Bachman (1851, vol. 2, p. 123). Dr. Bachman writes: "When the young are four weeks old, they begin from time to time to relax their hold on the teats, and may now be seen with their head occasionally out of the pouch. A week later, and they venture to steal occasionally from their snug retreat in the pouch, and are often seen on the mother's back securing themselves by entwining their tails around hers. In this situation she moves from place to place in search of food . . ."

There is some controversy as to just how often young opossums will wrap their tails about their mother's. That they do it occasionally, I do not doubt, for I have also seen them encircle her nose and her limbs with their tails as they desperately hang onto her fur with their feet. But from personal experience I have never seen a family of live opossums, as is sometimes pictured, with the tail of the mother carried over her back and with the young ones, in an inverted position, hanging over the mother's sides with their tails about hers. I rather doubt that this ever occurs. The young prefer to ride in a more normal upright position, with their heads over their mother's back, clinging to the hair on her sides; or if there is room, they may be well up on her back or over her neck. An opossum, especially when climbing about among the branches, is constantly using its tail as a balance and would be greatly hindered by having a family attached to it.

A person fortunate enough to take a photograph of a family of opossums with their tails attached to the mother's would do us a great service by sending it in, for such a picture should be published.

Milk when Milked

Sirs:

My friends and I were talking about domestic animals the other night, and during our discussion an interesting question arose that none of us could answer. Could you perhaps give us the answer?

Does a cow give milk all the time or only after she has calved? And what happens if she has calved once and no more? (We know that she gives no milk during her pregnancy.)

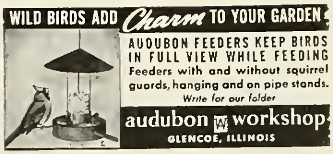
Gary Brauner
Bronx, N. Y.

The following remarks are offered by Dr. Lester R. Aronson of the American Museum's Department of Animal Behavior:

Young virgin cows (heifers) do not give milk. Lactation (the secretion of milk) starts immediately after the end of pregnancy when the young are born. The secretion of milk will then continue as long as the cow nurses or is artificially milked. However, there is a gradual decline in the amount of milk produced, so that farmers generally remate their cows before the milk production gets too low or ceases altogether. If nursing or milking is discontinued, then lactation will cease in a day or two.

These facts have been well known to farmers and animal husbandry men for centuries, but it is only within the last two decades that scientists have gained an understanding of the mechanisms involved in the production of milk. Except for minor variations, this mechanism appears to be the same for all mammals. Scientists have found that milk production is controlled basically by hormones. These are complex chemicals which are secreted directly into the blood stream of the individual by certain glands known as endocrine glands. Typical examples of endocrine glands are the pituitary, ovary or testis, thyroid, adrenal, etc.

There are four major aspects to the production of milk. The first is the growth and development of the mammary glands. This is largely controlled by a hormone known as estrogen, which is secreted primarily by the ovary. Following puberty when the ovaries become active, estrogen is secreted and the mammary glands begin to develop. The amount of this development varies considerably among the mammalian species. After pregnancy has started, ovarian activity increases greatly, much more estrogen is produced, and the mammary glands enlarge and develop at a faster pace. This mammary development is aided in most species by a second hormone known as progesterone, which is secreted in part by the ovary and in part by the placenta (the afterbirth).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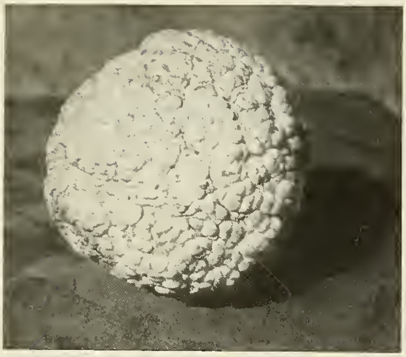
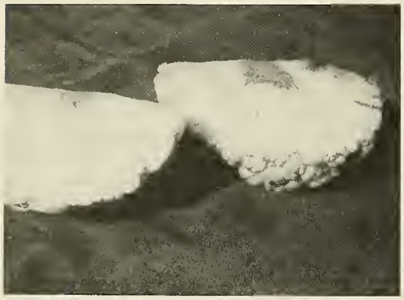
While pregnancy is in progress, a third hormone, lactogen (or prolactin), is accumulating in the pituitary gland, a small organ situated at the base of the brain. At the termination of pregnancy, the pituitary gland becomes highly activated and begins to secrete large amounts of lactogen. This lactogen initiates the second aspect of milk production, namely, the secretory activity in the mammary glands, or what is called lactation. Several factors seem to be involved in this sudden initiation of activity in the pituitary gland at the end of pregnancy. These are: (1) certain marked and rapid changes that occur in the ovary at this time, (2) the loss of the afterbirth and its secretory activity, (3) relaxation and collapse of the uterus, (4) a marked decrease in the amount of estrogen produced by the ovary, (5) the stimulus of nursing or milking. The importance of the last factor is demonstrated by the well-known fact that cows and certain other mammals can sometimes be brought into full lactation before parturition by the stimulus of milking.

The third aspect of milk production is the maintenance of lactation during the period of nursing and often far beyond. The major factor here appears to be the repetitive and regular stimulation of nursing or milking. This stimulation appears to work through the nervous system, which causes the pituitary gland to continue to secrete lactogenic hormone. In humans the so-called "wet nurses" who, in the days before artificial formulae were instrumental in saving the lives of so many infants, maintained their milk supply far beyond the normal nursing period by always having at least one infant at the breast. An older belief that the pressure caused by the actual accumulation of milk in the mammary glands caused the cessation of lactation has been questioned recently and appears not to be true, at least for some mammals.

The fourth aspect of milk production is the actual delivery or "letting down" of milk. This process is also controlled by the stimulus of milking or suckling, but psychological factors such as the sight of the young, the time of the day, or the sound of the farmer or milking machinery may be equally effective.



▲ THE FRUIT: a lumpy green globule



▲ INSIDE, the "orange" is fleshy and milky

Osage Orange

By DOROTHY D. FREAS

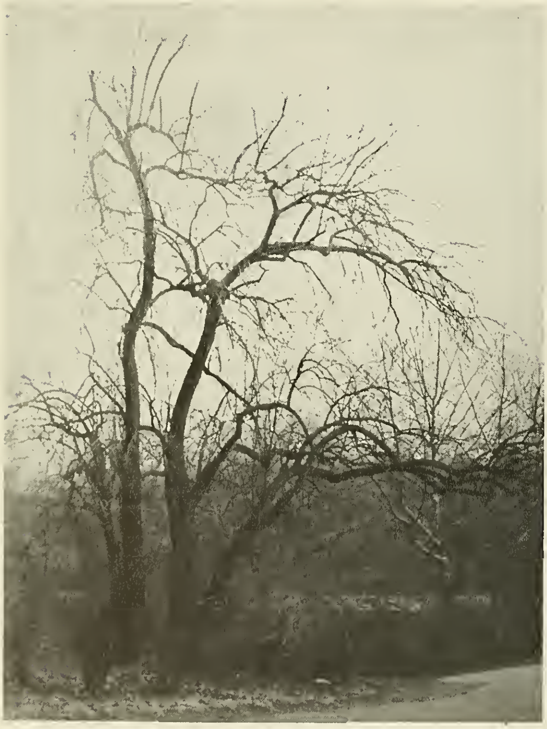
It looks like a fruit tree but acts like a fence

HAVE you found a *bois d'arc* "orange" in the park and looked around to find the tree from which it might have fallen? It is the fruit of the Osage orange tree—a green globule, fleshy and milky inside.

The branches of the tree are an orange-brown shade, although the trunk may be a rich brown. It grows 40 to 60 feet high, but the lowest branches are not far above the ground.

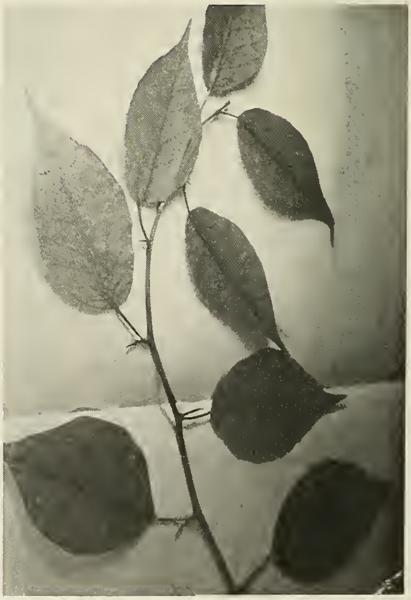
In the early days of colonization, farms in America were fenced in from the forest with a row of young Osage orange trees. It was too costly to put up a wooden fence, and these trees needed no repairs as they grew. In fact, they grew easily in the warmer sections of the Midwest. A cutting from an older tree would soon be a thriving new one. The Osage orange tree was pest-resistant and, having some thorns, it made a good protective fence in the days before barbed wire.

The Osage orange is not edible. The tree is a member of the Mulberry family and is technically known as *Machura pomifera.*



◄ THE OSAGE ORANGE grows 40 to 60 feet high

▼ ITS THORNS make it a good fence



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For 1951

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By HAROLD E. VOKES *Science Guide No. 75, Price 45¢, postage 5¢*

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This science guide shows the influence of the principal cereal grains on man's development from early times and how their cultivation went hand in hand with the domestication of animals.

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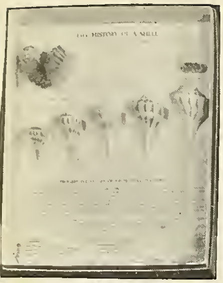

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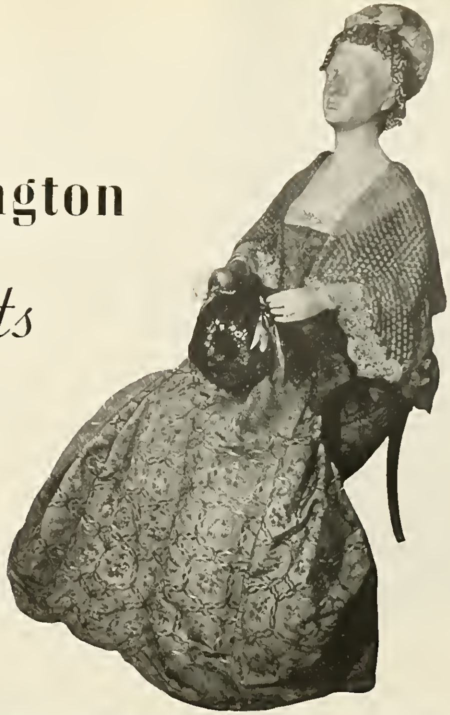
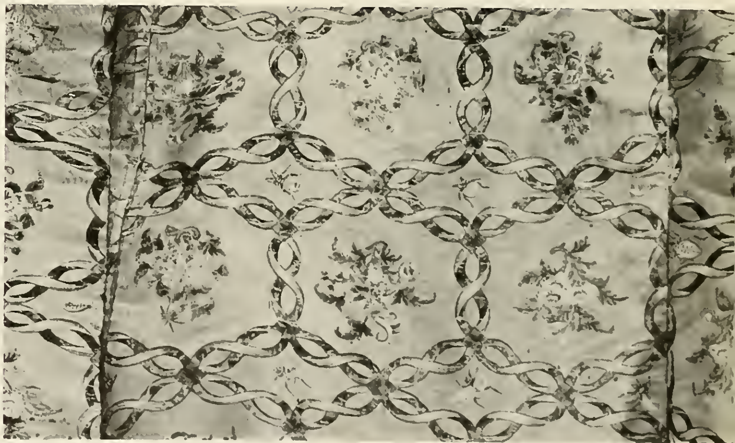
Martha Washington *Wore Insects*

By FRANK A. WOODFIELD



↗ DRESS worn by our country's First Lady. It is made of salmon-pink taffeta decorated with hand-painted insects and wildflowers

↓ DETAIL of the material in the dress above, showing the hand-painted insects with which Martha Washington was willing to identify herself



Photos courtesy Smithsonian Institution

MEN who are following the current vogue of wearing neckties decorated with butterflies, birds, rabbits, or other creatures of the wild may imagine that they are setting a precedent in fashions. Actually, the present mode can be traced back to the origins of our country and, indeed, far into the dim recesses of history. Insects were worn for adornment in ancient Egypt and earlier. It is a surprise to many, however, that our nation's first First Lady wore a dress decorated with insects. Moths, flies, wasps, bees, grasshoppers, spiders, ladybugs, and snails filled the spaces not otherwise taken up by a design of twining ribbons and flower clusters, including arbutus, buttercups, violets, morning glories, and daisies.

The dress is hand-painted and is believed to have been obtained for Mrs. Washington in England following the Revolution. But to the casual observer, the tiny creatures seem to be types common to this country. Unfortunately, the figures are so generalized that it is not possible to determine whether they were copied from specimens native to Europe.

Was Mrs. Washington a naturalist in the ordinary sense of the word? There are ample indications that she loved her garden, her flowers, her herbs, etc. But did her interests carry her so deeply into the field of nature that she was really fond of beetles, spiders, and snails, as well as the beautiful butterflies that undoubtedly added color to the Mount Vernon landscape? The question may have to go unanswered; but her gown, now one of the collection of dresses of mistresses of the White House, gives silent evidence to visitors to the National Museum in Washington that she was not too squeamish to wear likenesses of "crawly" things.

Whether her husband had such adornment is rather doubtful, although there is abundant evidence that men's waistcoats and jackets of that time were in some instances lavishly decorated with flowers and leaves.

LETTERS

Kon Tiki *and Pacific Migration*

Sirs:

Having read *Kon Tiki* by Thor Heyerdahl with great interest, I was happy to find the review of it in your December issue.

Gordon F. Ekholm and Junius B. Bird appear to believe that there is weightier evidence that "the peopling of the Oceanic islands resulted from movements outward from Asia."

I am very curious now to know what this school of thought has to offer in evidence for their hypothesis. The story *Kon Tiki* has taken hold of the imagination of a lot of people who have never previously concerned themselves very much with ethnological theories. And if *Kon Tiki* leaves the reader with misconceptions based on the "misstatements, half truths, and poorly reasoned anthropological speculations," the truth should be brought to light. On the other hand, if these critics are unfair in their estimate of Mr. Heyerdahl's logical conclusions, he should be supported . . .

May Orrell

Cardinal, Virginia.

The following comments are offered by Dr. Alphonse Riesenfeld, Research Assistant in the American Museum's Department of Anthropology, who is the author of a recent authoritative book on megalithic remains in Melanesia:

The Polynesian languages, in grammar and vocabulary, are related to the Melanesian, Micronesian, and Malayan languages, and their relationships extend as far distant as India, with an offshoot even to Madagascar. On the other hand, only a few isolated word similarities are recognized between the Polynesian and a few American languages, the validity of which is doubted for various linguistic reasons. In other words, we have a linguistic bridge connecting Polynesia with southeastern Asia but not with America, a fact inconceivable had the Polynesians come from America.

Two of the most typical Polynesian stone axes are those of quadrangular cross section and the kind that are known as stepped axes. They are widely distributed in many of the Pacific islands and are known as far as southeastern Asia. At the famous site of Yang Shao in southern China, the strata containing quadrangular stone axes have been dated at approximately 2000 B.C., and stepped axes of the Philippine sites cover the period 1250-200 B.C. Since Heyerdahl accepts A.D. 500 as the earliest date for the settlement of the Polynesian islands, the Polynesian stone axes can only have come to Polynesia from the west, where they are so much older and not vice versa.

Heyerdahl considers the personage Kon Tiki to be the founder of Tiahuanaco, a site very rich in pottery remains. If so, Kon Tiki must have been familiar with pottery. If he migrated directly from Peru to Polynesia, how is it possible that no pottery is found in Polynesia? The raw material has been available. The eastern Polynesian islands (Easter Island, Marquesas, Mangareva, etc.) are volcanic in character and produce clay as a disintegration product. On the other hand, Polynesians coming out of Asia had to cross many coral islands, where no clay is available and where therefore the art of pottery-making might have been lost.

As one of the reasons for his theory of an American origin for the neolithic or "new-stone age" Polynesians, Heyerdahl indicates that "there were no cultures in the world of any reproductive capacity which were still at the Stone Age level in A.D. 500 or 1100 except in the New World." This statement is incorrect on all points. First, at Tiahuanaco—the site associated with Kon Tiki—metal was so abundant that the people could afford to use copper tie-bolts to join large stone blocks. This pre-Inca culture was therefore no longer in a pure stone age. Second, from archaeological and ethnographic observations it has been proved that long after the introduction of bronze and iron, the use and fabrication of stone tools persisted in southeastern Asia, Indonesia, and as far as western New Guinea, in some places as recently as the twentieth century. Third, the fact that the Polynesians do not possess metals does not necessarily mean that their culture was derived from one lacking metals. In fact, the stepped stone axes of the Philippines (prototype of the Polynesian stepped axes) in the strata dated 1250 B.C. and later, are mixed with bronze objects. This leads to the conclusion that the Polynesians originally used metals but lost the art of metallurgy through lack of proper materials on coral atolls and most of the other Pacific islands. Indeed, many of the decorative elements in Oceanian art can be traced back to decorative elements of bronze objects.

The megalithic monuments of the Pacific islands are closely related to those of southeastern Asia in form and function. The people who introduced these monuments, according to the traditions, were light-skinned Malayo-Polynesian migrants. Now, in those areas where their migrations have been studied, as, for example, in Melanesia, they follow a continuous west-to-east course incompatible with an American origin. According to the traditions, the introduction of the coconut and the pig is attributed to these immigrants. This means that both these elements must have come to the islands from the west, if the traditions are correct. In fact, the coconut, which is very important in all the Pacific islands, was originally unknown on Easter Island and Rapa and rare in the Marquesas. It is absent in all Peruvian archaeological sites and is probably of post-Spanish introduction in the West Indies. Equally, the pig, which is considered by zoologists as of Indo-Malayan origin and which is known all over the Pacific islands, was originally unknown on Easter Island, Rapa, Tuamotu, and New Zealand as well as in America, where it is of post-Spanish introduction. If the Polynesians had come from America, the domestication of the pig and the use of coconuts should not be absent in aboriginal America and eastern Polynesia. The words for pig and coconut over wide areas of the Pacific are clearly Malayo-Polynesian. Also it is to be noted that both elements are lacking in aboriginal Australia, which has not been touched by Malayo-Polynesian migrations.

The theory of an American origin for the Polynesians is further contradicted by the current Polynesian tradition that their original homeland, Hawaiki, lies in the west. This tradition is corroborated by the belief that the spirits of the dead go to the afterworld in the west, thus retracing the migration route of their ancestors, as is the case in so many other native societies. The only Polynesian tradition speaking of immigrants coming from the east is that known on Easter Island, and there is not even unanimity

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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FEBRUARY, 1951

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THE COVER THIS MONTH

The Gila Woodpecker is one of the interesting inhabitants of the arid Southwest. It is a noisy and not unduly shy bird and is therefore easily observed.

It excavates its nesting hole in the stems of the stately giant cactus—a cavity extending about a foot downward from the horizontal entrance. The juice from the broken plant tissues gradually hardens around the excavation and in time forms a firm, shell-like lining. After the pulp of the plant has rotted away, this gourd-shaped lining may remain intact among the skeletonized fibers.

It has been reported that the time it takes for the sap to harden requires the birds to excavate a nesting hollow a year in advance. At any rate, new nests are not constructed every year, perhaps not until an old one is destroyed or, as may often be the case, pre-empted by some other desert dweller like the Elf Owl.

Nests are also constructed in cottonwoods and other trees, but they then resemble the nests of other members of the woodpecker family. The eggs are three to five in number and are plain white—a feature noted among many, though not all, birds that nest in holes.

—John T. Zimmer.

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*4 10-inch records $7.35 plus .30**

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Recorded by Edgar M. Queeny on an American Museum expedition in Anglo-Egyptian Sudan and East Africa. The set includes marabou stork, African lilly trotter, greater honey guide, laughing dove, robin chat, buffalo weaver, black boubou shrike, hornbill, great-chested chat, African fish eagle, and many others.

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OUT OF THIS WORLD

- - - - - - - - by Lowell Thomas, Jr.

The Greystone Press, $3.75
320 pp.

TO Occidentals, the name Tibet has always been synonymous with mystery, romance, and high adventure. No other region in the world is so little known, because getting into Tibet with official permission was almost as difficult as for the proverbial rich man to enter the Kingdom of Heaven. Up to the time Lowell Thomas, Jr. and his famous father crossed the roof of the world to Lhasa, only six other Americans had been admitted to the country.

The Thomases' visit came at the most critical period in the history of the Hermit Kingdom, for a few months after their departure, Communist hordes from China were on the march toward the sanctuary of the Dalai Lama. Therefore, Lowell, Jr.'s book is particularly timely. It is somewhat as if Marco Polo, returning from his "travels," had found publication of his book about them coincident with a war threat from Kublai Khan.

Never has a journey into a mystery land been so closely followed by so many people in so many countries of the world. Through the miracle of radio recording, the day by day account of the traveler's progress across the bleak Tibetan steppes was brought into every American home.

Now, a complete story of the journey has been given in *Out of This World.* The book is as unpretentious, as American, as young Lowell himself. He does not pose as an authority on Tibet, but he gives an enlightening background of the country, drawn from the accounts of earlier explorers. He tells of the vicissitudes of the journey; of what they did and how they did it; of the people and their customs; of an interview with the Dalai Lama and ceremonies in the mysterious gold-roofed temples; of the Tibetan nobility and the common folk. The book concerns a strange people still living happily in Oriental seclusion; a people who are about to die, as a nation, at the hands of Red assassins.

The Thomases saw Tibet with the Dalai Lama as the God Incarnate of the Lamaistic world. They were fortunate, and we are nonetheless fortunate that an enthusiastic American youth, with an educated but impressionable mind, should have written so compellingly of the last days of Tibet. I find it fascinating reading. It will remain in my library as a valuable historical document—a record of what was but will never be again.

ROY CHAPMAN ANDREWS

THE BEN LILLY LEGEND

- - - - - - - - - - by J. Frank Dobie

Little, Brown and Co., $3.50
237 pp.

THIS book is well named, for a full account of Ben Lilly has to deal with much that must be characterized as legend. Like Paul Bunyan, but to a lesser degree, Ben Lilly is credited with tall achievement. Within his field of special training he was exceptionally competent, and many of the surprising stories told of him are well attested. Dobie, with the thorough preparation which is a hallmark of any book he writes, gives the reader a great mass of biographical data and the trimmings based on it by hearsay.

Ben Lilly, 1856-1936, has the reputation of a great bear hunter. Killing bears seems to have been an obsession with him, and conservationists who read this book will be thankful that he was unique. When one gives due consideration to the element of courage and endurance that Lilly brought in full measure against bears wherever encountered, the balance of his activity is a merciless campaign of extermination. Because he typifies the hardy pioneer who saw nothing remiss in taking a ruthless toll of nature, one can learn from his biography something of the psychology of such an individual.

He was a man of strong convictions, which conformed in some respects with the better aspects of human nature but in others brought out less admirable traits. He would not work on Sunday and carried this determination to extreme lengths. He was fearless and fought bears under conditions that no normal hunter would dare accept. He was indefatigable, traveling day and night and going without food over long periods. He was tougher than the bears and mountain lions he hunted. He was a keen observer and knew the habits of wild animals. And in some of his personal habits he seemed to have had much in common with the wild animals.

I think the average reader will have mixed emotions after reading this book. He will have great respect for the rugged qualities of the Lilly character; he will marvel at the one-track mind that drove Lilly roughshod over time and convention; but he will deplore the fact that all of this force and determination was directed toward killing.

HAROLD E. ANTHONY

BEES:

Their Vision, Chemical Senses and Language

- - - - - - - - - - by Karl von Frisch

Cornell University Press, $3.00
119 pp., 61 illusts.

THIS admirable little volume should commend itself to a host of readers and for a variety of reasons. In this generation—and one might well extend the statement to include the generations of the past—there is no one who has delved more persistently or more ingeniously and adroitly into the capacities of the honeybee than the distinguished melittologist, Professor Karl von Frisch. The facts he has painstakingly established after about 40 years of devoted investigation are among the most startling yet revealed regarding an insect that has offered many surprises.

Those who attended the three lectures Professor von Frisch delivered before the American Museum in the spring of 1949 as well as those who heard him give some or all of these lectures in other parts of the country will no doubt welcome the opportunity to retrace, through the printed word and with photographic supplementation and diagram, the curious discoveries which he imparted in his entertaining talks. Those who missed these lectures owing to distance or inaccessibility now have the chance to retrieve a missed opportunity.

In addition to these general audiences for which the book has appeal there are the special groups of readers to whom it is a prime necessity. The students of animal behavior will find it indispensable, and entomologists, even

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those interested in orders other than the Hymenoptera, can ill afford to neglect its contents. While primarily concerned with research undertaken for its scientific interest alone, the book has its practical aspects that concern the agriculturist and the apiarist. Some of the techniques may be applied with advantage to assure the more adequate pollination of a desirable plant, to obtain a higher yield of honey, or for other objectives of personal interest or of benefit to the community as a whole.

As the subtitle indicates, the book is devoted to the vision, chemical senses, and language of the bees—one hastens to add (perhaps a little unnecessarily) that the "language" is not communication by sounds but information imparted by body motions and flower-derived scents, or even self-secreted scents. An appendix adds certain vital experiments and observations made since the lectures were delivered in this country, and an ample bibliography offers guidance to those who wish to delve more fully into the pertinent literature.

HERBERT F. SCHWARZ

GREAT AMERICAN NATURE WRITING

Selected and with Commentary by Joseph Wood Krutch

William Sloane Assoc., $5.00, 444 pp.

EVERY anthologist is confronted with the problem of selection. On the whole, Mr. Krutch's selections are good examples of outstanding American nature writing. However, since the title of this anthology indicates that these selections are samples of "great" American nature writing, the anthologist has placed an extra burden upon himself, that of passing judgment as to the relative quality of the efforts of the authors included in the anthology. Writers such as Thoreau, Muir, and Burroughs have been established in the minds of many as leaders in their field of writing. The recent writers whose works are included are well known, but one hesitates at this time to confer upon them the mantle of greatness. Devoe, Beebe, and Peattie are outstanding, but time will tell whether or not their works are to have a lasting significance. Some of the writers included are far better known for their activity as explorers, naturalists, and scientists than for their extraordinary literary ability, such as Vilhjalmur Stefansson, Richard E. Byrd, and William Morton Wheeler.

Samuel L. Clemens is in a class by himself, and his work has its established place in the general field of American literature. His "Roughing It" may be a significant example of American nature writing, but Clemens will be remembered for his other works.

The pieces selected, which are not necessarily the better-known works of the authors, should have wide appeal. For example, the short but powerful editorial type of essay by Alan Devoe on the sad fate that befell a sea cow in "The Brave Men of Brielle" shows a feeling for nature as intense as that displayed by Richard E. Byrd in the excerpt from his book *Alone*.

I missed a few select items such as Lafcadio Hearn's "The Storm" and Rockwell Kent's *Wilderness*, but no anthology can completely satisfy everyone. Harry Beston's "The Headlong Wave" has as much a feeling of the sea as Hearn's "The Storm," and Byrd's *Alone* is perhaps more moving than Kent's *Wilderness*.

Krutch's attempt to show that American nature writing is "an emergent literary form struggling for its own independence" is in my opinion too lengthy. An anthologist has the privilege of commenting on his selections, but a hundred pages or so of essay and comment may disturb some readers who are more interested in the selections in the anthology than in the anthologist's own writing.

Rudolf Freund's delightful decorations embellish this unusual and ambitious effort of anthologist Krutch.

JOHN R. SAUNDERS

THE SCULPTURE OF NEGRO AFRICA

- - - - - - - - - by Paul S. Wingert

Columbia University Press, $4.50
96 pp., 118 plates,
numerous line drawings

SINCE the early part of this century, African Negro sculpture has exerted a marked influence on the art of Western Europe, and the impact of this tradition is reflected in the works of such painters and sculptors as Picasso, Derain, Vlaminck, and Laurens. Native African sculpture has long been appreciated in art circles, and several leading museums in this country and abroad have featured it in major exhibitions, yet there have been surprisingly few attempts to characterize the several regional and tribal styles that compose this great tradition, or to make them known to the general public. In the present handsome and important book, Dr. Wingert undertakes both objectives.

The author classifies African Negro sculpture in accordance with four main geographical regions: West Africa, Cameroon, Central Africa, and East Africa. Within each of these areas he further defines and characterizes a number of tribal styles. These descriptions are greatly enhanced by a profusion of pen-and-ink vignettes placed conveniently in the margins, as well as by the numerous and excellent plates. The specimens illustrated have been drawn exclusively from American collections, and typical examples rather than exceptional pieces have in most cases been selected.

Generally speaking, there are two principal approaches to primitive art. The art critic judges an object aesthetically and in terms of its artistic qualities. The anthropologist, on the other hand, treats it as an element of culture and appraises it with reference to its ethnological significance. In his approach to African Negro sculpture, Dr. Wingert falls somewhere between these opposing trends. Unlike earlier critics who dealt exclusively with the aesthetic features, he carefully sketches the cultural background and discusses the purposes the carvings were made to serve. Yet, in spite of the attention paid to cultural context, the sculptures are illustrated as "Art" rather than as ethnological specimens. Similarly, although Dr. Wingert's approach to the material is in the best anthropological tradition, the tribal styles are to a large extent described in the special terminology of the fine arts world, a jargon often obscure to the uninitiated.

In order that the accuracy of the stylistic characterizations may be evaluated, it should be borne in mind that for very few of the many objects illustrated is the precise tribal origin given. To the artist such omissions will make little difference, but they are bound to disturb the anthropologist. This volume is, nevertheless, the most scholarly and comprehensive treatment of the subject to date, and it fills an important need both as a text and as a reference book.

Harry Tschopik, Jr.

THE STORY OF MOUNTAINS

by Ferdinand C. Lane

Doubleday and Co., $6.50
488 pp., 32 illusts.

THIS king-sized book tells all about mountains, how they are formed, where they are located, and what special circumstances qualify them for particular comment.

A mountain is a breath-taking object whether one gapes at it from the foot or gasps from the summit. Some mountains are, beyond question, the most awe-inspiring spectacles on earth. Primitive peoples were stirred by towering mountains, as is evidenced by the names they gave them. Courses of empire have been dictated by the location of mountains.

Dr. Lane writes his story in simple readable terms, documenting it by frequent references and highlighting it by glorious half-tone illustrations. The plates alone are worth the price of the book. The treatment is by a series of short chapters, one hundred fourteen of them, which begin as introductory material, pass through a great panorama of special relationships, i.e., mountains in history, mountains in geography, mountain biology, etc., and conclude with a broad outline of mountains as distributed on a continental basis.

There are many anecdotes of mountain climbing, hairbreadth escapes, and dire tragedy. Technological advance makes it possible for man to fly about the top of Everest, but to climb the mountain he still must rely upon the equipment nature gave him—stout legs and heart and sound lungs. Unless he has these, all the gadgets that make him comfortable afoot or in camp are of little avail. But modern man is a better mountain climber than his primitive ancestor. Mountain climbing is a science today which takes full advantage of cordage, metal, and weather reports. The number of unclimbed peaks is dwindling. But human nature is such that as long as one exists, it will be a constant challenge to the hardy few who long to set foot on it. Most people, however, will find it far more attractive to do their mountain climbing vicariously from the pages of this book.

Harold E. Anthony

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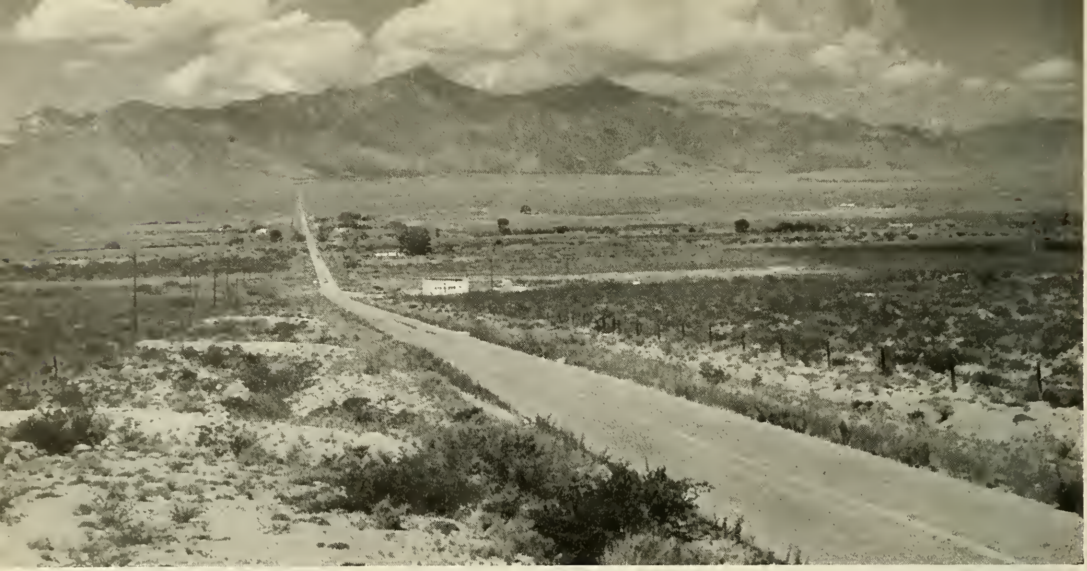


Weldon F. Heald photo

▲ **The Huachuca Mountains** straddle the Mexican border and provide a "vertical oasis" in the arid grasslands of the San Pedro Valley. Students are only beginning to realize the diversity of climate and life in this paradise

▼ **Flashlight photography** appeals to the outdoorsman equipped to stay overnight in this mysterious world of forest and crag

C. F. Stoody photo from Western Ways

Sky Islands o

By

Weldon F. Heald

To most of us, islands are fascinating places. They stir our imaginations with their complete, self-contained independence, isolated from the rest of the world by wide stretches of water. However, some of the earth's most interesting "islands" are nowhere near oceans or lakes. They are strictly land islands but with a climate, vegetation, and animal life as different from their surroundings as if they rose from some remote sea.

Such a group of land islands are the dozen or so mountain ranges in

Lark photo from Western

▲ A PANTHER, sharp of tooth and claw but as much a part of the wilderness as the animals on which it preys

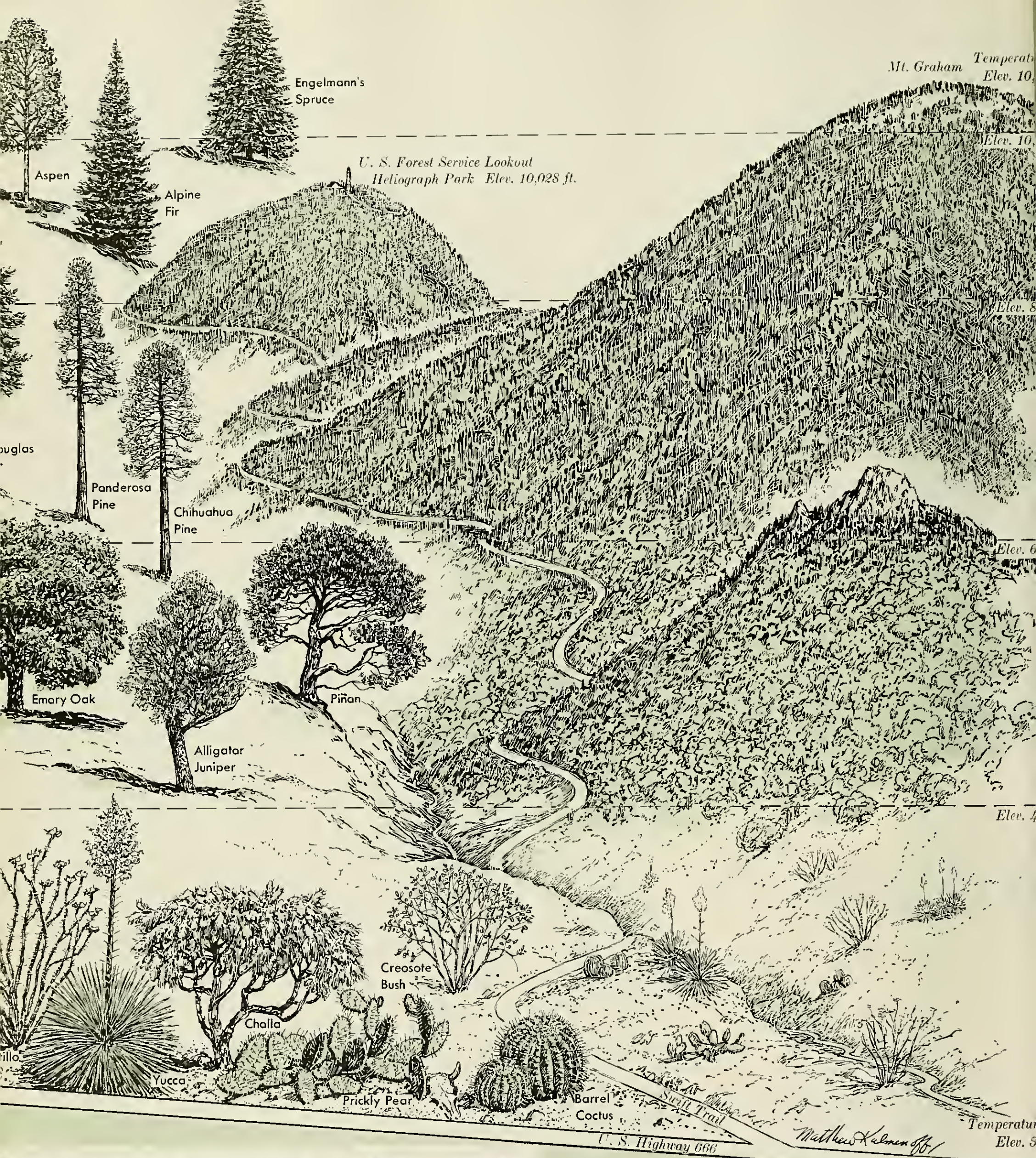
RIZONA

From a searing desert near the Mexican border to the bleak subarctic in three hours and a half. Roam these mysterious isles in the clouds, and you will become almost every kind of an explorer at once

Arizona's southeastern corner. They show all the characteristics of real islands, except that they are separated from one another by dry land. Twenty to forty miles long and arching into the blue Southwestern sky to heights of 7500 feet to nearly 11,000 feet, these great isolated ranges stretch north and south across a semiarid, wide-sweeping highland country the size of West Virginia.

Out of a sea of desert and rolling grasslands, southeastern Arizona's mountain-islands thrust their summits into a climate comparable to that of Labrador and carry upon their broad backs a cluster of cool northern evergreen forests 600 square miles in extent. Up in these surprising, high-perched oases, just north of the Mexican line, are shaded roads and trails through pine, fir, spruce, and aspen woods. There are wildflower meadows, too, lush fern brakes, tumbling streams, and hushed camp sites where you can hear the twilight song of the hermit thrush. Nowhere on the continent is the cooling effect of altitude more strikingly demonstrated, nor is there a more abrupt meeting of cactus-spiked desert with luxuriant temperate forests.

These ranges show similar family characteristics, but each has a personality distinct from its neighbors. In this way they resemble individual islands of a group, such as those of the Azores or Hawaii. Like islands, too, each range has developed unique varieties and even species of plants, animals, and birds unlike those found anywhere else. Thus the Chiricahua Mountains are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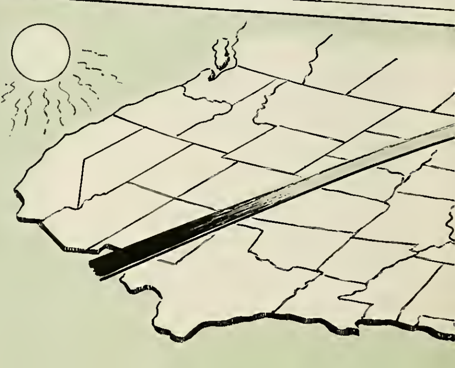
THE MOUNT GRAHAM CLIMATE LADDER

ON this Arizona "Sky Island" you can drive your car in one hour from the desert to pine and fir forests with a climate like that of northern Minnesota. A four-mile hike then takes you to the summit, where the climate is comparable to Canada's Hudson Bay. In less than half a day, the climatic ladder has taken you through all the zones you would meet in traveling 2200 miles north. Climate so profoundly affects plant life that botanists have long been accustomed to dividing the slopes of mountains into vegetational zones roughly like the ones that are determined by latitude.

A drop of 1 degree F. for every 100 feet in altitude is frequently taken as the average. But the variation from this is great, especially in summer. The day that the author made this ascent, the drop averaged 1 degree for every 132 feet—from 108 degrees at 3321 feet to 52 degrees at 10,713 feet. This is not unusual for the summer rainy season in southern Arizona.



HUDSONIAN ZONE

Climate: central Labrador
Precipitation: 40 in. yearly
Vegetation: Engelmann's Spruce, Aspen, Alpine Fir

CANADIAN ZONE

Climate: summer, northern Maine
winter, Connecticut
Precipitation: 30 to 40 in. yearly
Vegetation: Ponderosa Pine, Mexican White Pine, White and Douglas Fir, Aspen, Birch, Maple, Dogwood

TRANSITION ZONE

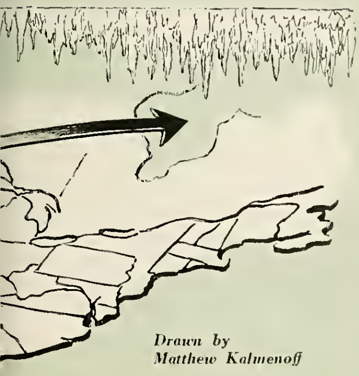
Climate: summer, central Minnesota
winter, Tennessee
Precipitation: 20 to 30 in. yearly
Vegetation: Chihuahua Pine, Ponderosa Pine, Mexican White Pine, White Fir, Douglas Fir, Utah White Oak, Silverleaf Oak, Netleaf Oak, Maple, Alder

UPPER SONORAN ZONE

Climate: summer, New Jersey
winter, Mississippi
Rainfall: 10 to 20 in. yearly
Vegetation: Emory and Arizona White Oak, Alligator Juniper, some Piñon. Chihuahua Pine in higher levels

LOWER SONORAN ZONE

Climate: northern Mexico
Rainfall: 8 to 10 in. yearly
Vegetation: Prickly Pear, Barrel Cactus, Cholla, Ocotillo, Yucca, Creosote Bush



Drawn by Matthew Kalmenoff

inhabited by the Apache squirrel; the Huachuca Mountains have a different species, the Huachuca gray squirrel; and localized varieties of the latter appear in the Santa Rita, Santa Catalina, Rincon, Pinal, and Pinaleno Mountains.

This remarkable differentiation between neighboring ranges persists throughout the animal, bird, reptile, and insect population and even applies to plants. It indicates that for centuries these mountains have been marooned fragments of a colder climate—perhaps since the close of the last Pleistocene Ice Age, some 20,000 years ago.

On the other hand, Arizona's sky islands have served as stepping stones connecting the north and south. They act as a sort of land archipelago that has carried some plants and animals across the intervening desert barrier. So there is an unusual blending of northern plant and animal life with that of Mexico. Black bear, white-tailed deer, and porcupine cross trails with the Mexican mule deer, peccary, or wild pig, and with that strange long-nosed relative of the raccoon, the coati mundi. Mexican mountain lions range up from the south, and jaguars, ocelots, thick-billed parrots, and rare coppery-tailed trogons make occasional visits. Our generally sober northern insect population is here enlivened by gaudy Mexican grasshoppers, huge multicolored moths, unfamiliar butterflies, and beetles carrying exotic designs suggestive of the Aztec. Many Mexican trees, shrubs, and flowers extend up the land archipelago, while the Engelmann's spruce and alpine fir come down from the north from mountaintop to mountaintop to make their southernmost stand in the Chiricahuas, 20 miles from the border.

With such a scrambled mixture of growing, flying, running, and crawling specimens, these ranges are happy hunting grounds for naturalists. They come from all parts of the country to track down new species and to endeavor to straighten out the tangled natural history of the region. One authority states that within its seventeen square miles,

▼ AT THE FOOT of Mt. Graham, the creamy flowers of the yucca bloom on the desert floor. A scene at the foot of Swift Trail

Weldon F. Heald photo

Herbert photo from Western Ways

⮝ PORTRAIT OF A PECCARY: an animal that is sometimes reluctant to yield ground in the presence of a human being. From a mounted specimen

Chiricahua National Monument has a greater range of plant life than any equal-sized area in the country. At any rate, 507 species of plants representing 80 families have been identified there, and all experts agree that southeastern Arizona is an unrivaled natural botanical garden, zoo, and aviary.

Favorite collecting grounds are the Huachuca Mountains, because they straddle the Mexican line and thus provide a convenient, undisturbed port of entry for southern animal migrants. For years naturalists have hit the jackpot there with an amazing diversity of mammals, birds, snakes, lizards, and insects, and each season additional varieties and species are discovered. The Mearns's quail and Mearns's woodpecker were Huachuca finds, as were the very rare Huachuca black-headed snake and Willard rattlesnake, a pygmy Mexican form only fifteen inches long. Dr. Herbert Brandt spent several summers in the Huachucas and Chiricahuas studying the birds. His forthcoming book, *Birds of Southeastern Arizona,* lists a score of species and varieties found only in these mountains.

Weldon F. Heald photo

⮜ THE CRAGS and evergreen forest of the Santa Rita Mountains rise 7000 feet above the desert of Santa Cruz Valley. Florida Canyon carries one of the finest Douglas fir forests outside of Oregon

Bill Sears photo from Western Ways

▲ **The collared peccary** is at home among the desert cactus or mountain evergreens. It is sometimes called a "wild pig"—an inappropriate name, for the animal belongs to a distinct family

Weldon F. Heald photo

▲ **Heliograph Peak** (10,028 feet) from Swift Trail, showing trees "cloud-frosted" by freezing mist in the first cold weather of fall. The fire lookout tower, 90 feet high, gleams in a casing of ice

McVey photo from Western Ways

▲ **Curiosity and timidity** battle in the gopher's mind as it questions your intentions in the Sky Islands of Arizona

Last year, Mr. Woodrow Goodpaster, collecting for the University of Illinois, ran a line of 100 traps up Miller Canyon in the Huachucas and caught and prepared more than 500 mammal specimens in a month. One of his prizes from a Huachuca cave was a tailless bat not known previously to inhabit the region. Mr. Charles Bogert, well-known herpetologist from the American Museum of Natural History, is a frequent visitor, as is Mr. William Woodin III, another authority on western snakes. This summer Dr. W. S. Creighton of the College of the City of New York came to the Huachucas looking for ants. He found them—at least one species hitherto unknown.

Three newcomers are Dr. Harold Edgerton, Professor of Electrical Measurements, Massachusetts Institute of Technology, Robert J. Niedrach, Curator of Birds, and Walker Van Riper, Curator of Spiders, both from the Denver Museum of Natural History. They made a field trip this year in co-operation with the National Geographic Society. Dr. Edgerton has developed a high-speed color camera using electrönic flash tubes, which catches birds and insects in action with a fantastically rapid exposure. These three men concentrated on hummingbird portraits and obtained some magnificent action shots of three species.* Dr. Niedrach believes there are three or four more kinds of hummingbirds in the Huachucas—and, like most naturalist visitors before him, he is coming back.

All this scientific activity was bound to affect the ranchers, retired Easterners, writers, and artists living on the pleasant "Huachuca Strip" along the east base of the mountains. To them bugs, spiders, scorpions, centipedes, snakes, skunks, and gophers are no longer varmints, pests, and nuisances; they have become valuable specimens to be carefully snared, preserved, identified, and exhibited. For the local inhabitants are the proud possessors of an ambitious new museum.

The Huachuca Museum, housed in a fine, roomy building, once the post library of historic Fort Huachuca, was established in 1950 to preserve and graphically display permanent representative collections relating to the geology, prehistoric Indians, history, and natural history of the region. Specimens are already pouring in, and the visiting naturalists are helping by giving advice, assistance, and their specialized knowledge. But the greatest problem before the museum would seem to be to make a wise selection from an overflowing abundance of riches.

However, you need not be a naturalist or collector or expert to be struck by the unique climate, flora, and fauna of Arizona's sky islands. Even casual tourists notice them and are impressed, particularly by the larger mammals. Perhaps the mountain lion takes first place in general interest, and stories of the big cats are listened to with bated breath by newcomers and old-timers alike.

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* For action shots of the Broad-tailed Hummingbird, see "Whistling Wings" by Walker Van Riper and Robert J. Niedrach in Natural History for January, 1950.

Weldon F. Heald photo

▲ **Winter snow** on the Huachuca Mountains a mile and a half north of the Mexican border. Miller Peak at left (9445 feet) and Carr Peak at right (9214 feet)

These mountains are breeding grounds for the southern brown cougar. The Huachucas provide an open back door for a constant influx of these animals from Mexico, so there are probably as many today as there were 40 years ago. Whether you call them cougars, mountain lions, pumas, panthers, painters, or catamounts, they are the same powerful, lithe, tawny beasts with a deadly lightning attack and an intelligence surpassed by few wild animals. A mountain lion's diet consists of anything that walks, runs, crawls, or flies, and too often for the rancher's peace of mind, it includes his calves, colts, chickens, pigs, and dogs. Hunters, too, revile mountain lions for beating them to the kill of thousands of deer each year, in season and out.

So a bitter war of extermination has been waged for many years by ranchers and farmers against the big cats. But it would be disastrous if they were successful. Even these animals serve their purpose in a wildlife community. They act as natural balance wheels in primitive areas and are as useful in their way as are the creatures upon which they prey. The cougar is a part of our rapidly vanishing American wilderness, some of which should be preserved for the enjoyment and inspiration of generations of Americans to come.

It is difficult for a cattleman who has recently had two of his calves killed by cougars to assimilate this balance-of-nature philosophy. But fortunately in the early 1930's the United States Forest Service began to set aside a few of the wildest and most rugged sections of the national forests as examples of primeval America as it was before the white men came. In these unspoiled pieces of the original wilderness, roads, buildings, and resorts are taboo, and they are preserved solely as havens of outdoor camp and trail life.

There are two Forest Service primitive areas in the mountains of southeastern Arizona. The Galiuro Wild Area contains 55,000 acres of knifelike ridges and steep, timbered slopes rising 4000 feet above the San Pedro River valley. The 18,000-acre Chiricahua Wild Area includes fine forests, fantastic rock formations, and 10,000-foot peaks. These, together with Chiricahua National Monument and several Forest Service natural areas, total 90,000 acres of land preserved as untouched biotic communities.

But Mexico, too, acts as a great game preserve adjacent to the Arizona border. Occasionally magnificent "El Tigre," the largest of North American cats, prowls northward. Primarily a tropical animal, ranging from Mexico to Patagonia, the jaguar was encountered by early pioneers as far north as Colorado and Arkansas. A few have been reported in Arizona, New Mexico, and Texas in recent years, and a fine young specimen weighing 110 pounds was killed near Arivaca, west of Nogales, in 1949. But furtive "El Tigre" dislikes our high-pressure civilization and now visits us only on rare occasions. Golden-yellow with coal-black spots, jaguars take second place to few animals in beauty and to none in agility and stealth. Measuring up to 8 feet long and weighing 250 pounds, these great cats are among the world's most powerful and ferocious creatures.

The ocelot is another southern member of the cat tribe that now and again strays north of the border. About the size of a wildcat, this nocturnal animal is handsomely marked with irregular stripes, bands, and dots on a tan background, no two individual designs being quite the same. But ocelots may have finally abandoned Arizona's sky islands, for not one has been reported in several years.

Quite at home, however, among desert cactus and sage or mountain pine and fir are the peccaries, distant relatives of the wild boars of the Old World. They are tough pig-like animals of about 40 pounds, and they often travel in large droves. Although the white-lipped variety of Central Mexico is more formidable, the collared peccary of Arizona has little fear of humans and may be dangerous when cornered, as its sharp tusks are effective weapons. Hair-raising tales are told of peccaries running people up trees and keeping them prisoners there, but there seems to be some difference of opinion as to how dangerous this animal actually is.* I passed within 20 feet of a large male peccary on a forest trail last summer. He stood his ground, watching me suspiciously with his little beady

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* See "Wild Pigs of the Desert," by William H. Carr, Natural History Magazine, October, 1946.

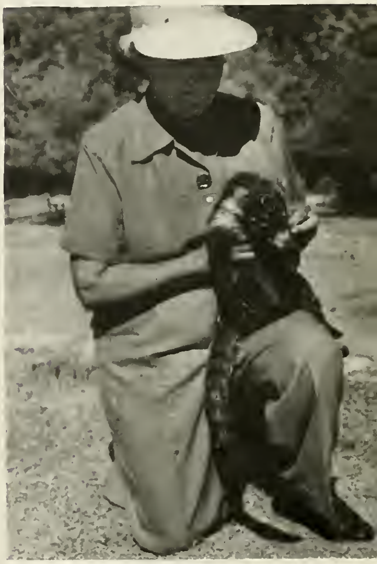
eyes until I was out of sight. As I was on foot and never carry a gun, the feeling of uneasiness was mutual.

Then there is the coati mundi, a surprising "believe it or not" animal of Central America that ranges north into southern Arizona's mountains. If it were biologically possible, the crossing of a monkey, cat, anteater, and raccoon might result in something resembling a coati. Covered with grayish or tan fur similar to a cat's, it has a long body and tail, streamlined forward into an elongated, pointed, upturned snout. Coatis are aboreal and feed on birds' eggs, lizards, and insects. Locally called chulas in Arizona, these queer hodgepodge animals have an undeserved reputation for ferocity. You hear stories of chulas hanging from branches by their tails and dropping down to eviscerate with their catlike claws innocent, unsus-

Continued on page 95

C. F. Stoody photo from Western Ways

▲ A FOX PHOTOGRAPHED by flashlight in the region of the Sky Islands



Weldon F. Heald photo

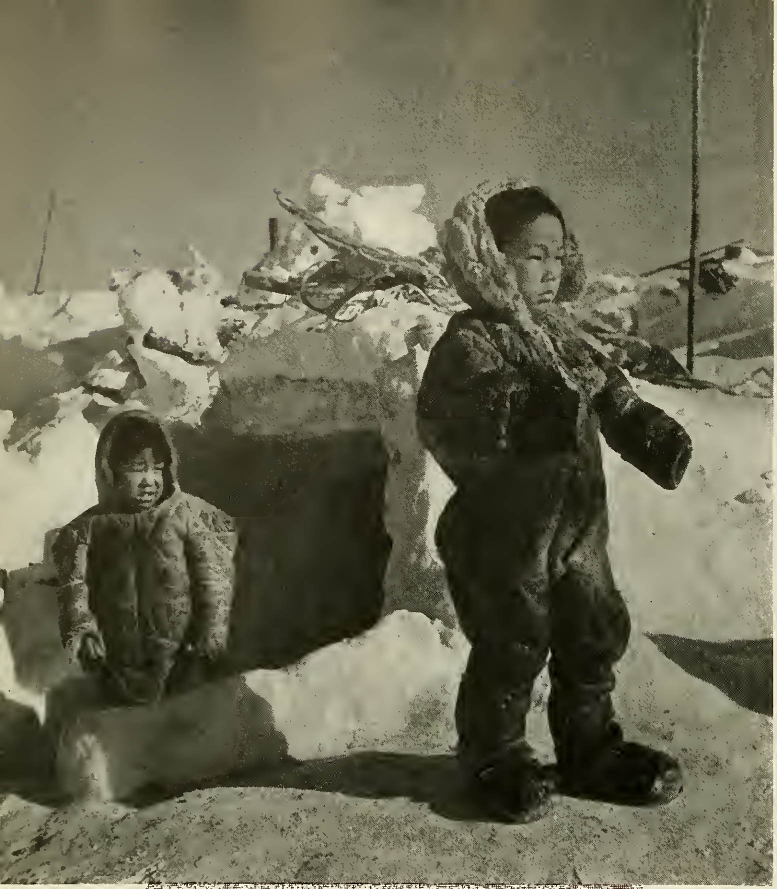
▲ THE COATI MUNDI, a distant long-nosed relative of the raccoon. It is a Central American animal that ranges through Mexico into the mountains of southern Arizona. It makes an excellent pet, but its sharp claws sometimes inflict serious scratches, even in play

Weldon F. Heald photo

◄ A CAMPGROUND in the Pinaleno Mountains among giant firs, spruces, and aspen groves

▼ AS THOUGH RISING from a sea of desert, the Sky Islands of the Mule and Huachuca Mountains project from the vast grasslands of Sonoita Valley. A view from the 9000-foot ridge of the Santa Rita Mountains

Weldon F. Heald photo



◂ **One-piece suits** of caribou skin with the hair turned in keep the children warm outdoors when the temperature is well below zero. Rifles and other implements are piled on top of the entrance roof

▸ **Two Eskimo girls,** dressed in caribou skins and wearing polished brass headbands made from discarded primus stoves. Note the strings of colored beads—another modern touch

Life in a SNOWHOUSE

Glimpses of the home life of a group of people who find comfort in the depths of winter with only a dome of snow to shelter them

THE unusual photographs shown on these pages were taken by the Right Reverend D. B. Marsh, Bishop of the Arctic for the Anglican Church of Canada, who has spent much time in the Barren Grounds west of Hudson Bay. These photographs portray the winter life of a band of Caribou Eskimos of the Padlemiut tribe, who, unlike most other groups, spend most of their lives inland from the sea.

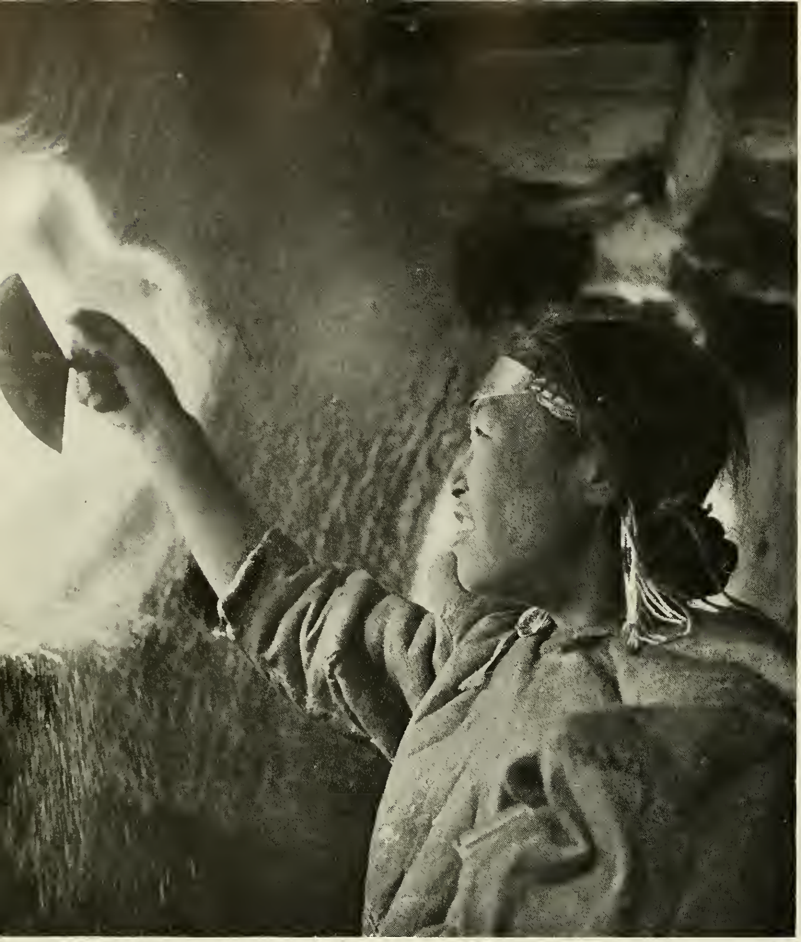
The Eskimo snowhouse has always captured the imagination of people living in lower latitudes, and many have come to suppose that all Eskimos live in snowhouses the year round. This is not the case, because the snow melts in summer even where the Eskimos

live. In fact, it would be exceptional for a snowhouse to be used after April or May, and a new one cannot be built until October or November. So snowhouses are only occupied for about half of the year, or less. Most Eskimos, furthermore, have never seen a snowhouse. But this does not mean that this unique dwelling is not exceedingly important to the 8000 or so who have used it as their only winter home for many centuries.

The snowhouse is supreme all the way from Coronation Gulf to the Ungava Peninsula in Quebec, and it is used to some extent beyond. It is regularly used on the trail by the Polar Eskimos of northern Greenland and occasionally by Eskimos in northern Alaska.

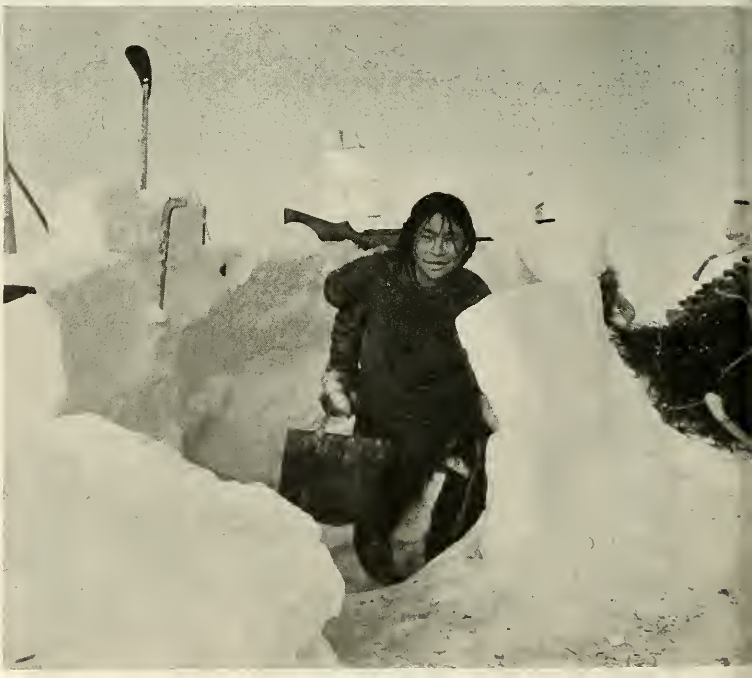
Strange as it may seem, it is possible to keep the inside of a snowhouse at from 40 to 60 degrees Fahrenheit without melting if the air outside is cold enough to neutralize the warmth within and prevent melting temperatures in the thin layer of air next to the snow.

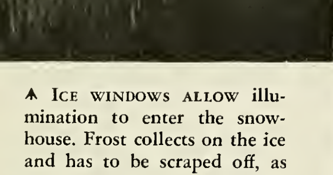
However, Bishop Marsh informs us that these Padlemiut Eskimos live in temperatures sometimes as low as 40 degrees below zero inside the snow hut. They burn scrub vegetation in the porch or vestibule but have no heat in the snowhouse itself. Most Eskimos, living on the sea, have supplies of seal oil, which they burn for heat as well as light. The caribou tallow that the Padlemiut Eskimos use is burned primarily for light. It is also clear from the photographs that they are acquainted with the primus stove of civilization.



▲ Ice windows allow illumination to enter the snowhouse. Frost collects on the ice and has to be scraped off, as shown here, with the women's *ulu*—a knife that is used for everything from making boots to cutting off bites of meat. The wooden pieces in the ceiling are tent poles, which these Eskimos always build into the upper part of the snowhouse, covering them with the tent cover

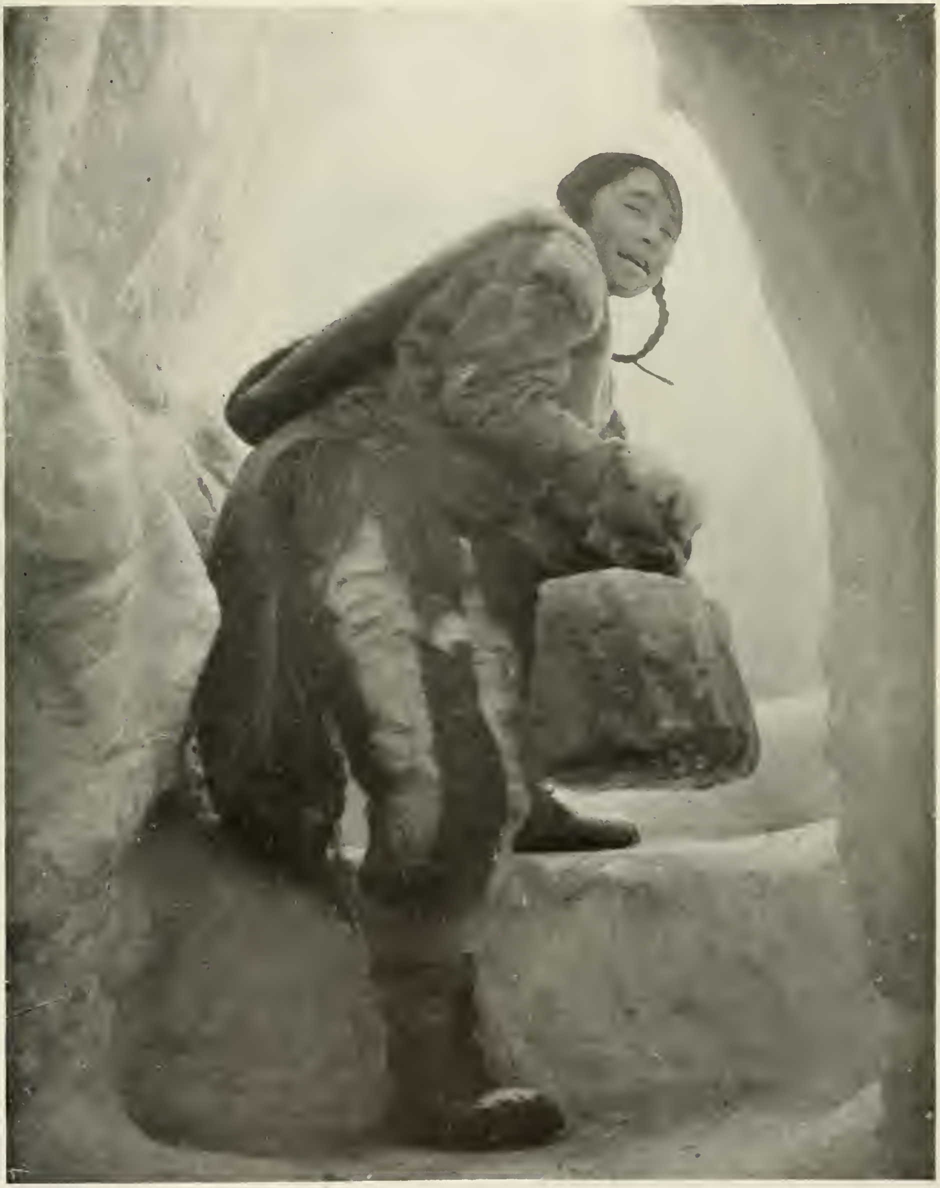
▼ Emerging from the entrance passage, the woman of the house carries a skin bucket in which to fetch water from a hole in the ice. The scoop projecting from the snow at left is used to remove the loose ice from the hole





◀ THE ICE HOLE is kept open each day so that water can be drawn. The ice is chipped with a chisel and then scooped out as shown here. Coming from a lake or a river, this water will be fresh; but when camped on the sea ice, Eskimos either have to melt snow or find ice that is old enough to have lost its saltiness

▼ THE FULL BUCKET of water is being brought down the steps into the snowhouse, ready for tea or a cool drink of water any time



Charade of the Honeybee

One of the most breath-taking disco

By N. J. BERRILL
McGill University

Edwin Way Teale photo

ANIMALS move and plants vegetate, oysters and tumbleweed notwithstanding. And movement, if it is not merely drifting with the currents of air or water, demands sensitive recordings as well as an operative mechanism. For movement is purposive. It is useful primarily because it puts the animal in the right place at the right time. Of course, the animal may only need to *stay* in the right place, as a jellyfish needs to stay above the dark void of the oceanic abyss. More often, movement is essential because it enables the creature to pursue prey or to escape capture. Another end of movement is seen in the more selfless enterprise of migration, in which the bird places its eggs in such a location that the succeeding generation will be in the right place at the right time—in other words, where the young will have the proper food and temperature at that time of year.

But whatever the aim, movement requires an animal to respond to factors that define its position in relation to the world around it. Many lowly animals move only in close contact with the ground and maintain an intimate sensory and locomotory connection through immediate touch, but most of them have some sensitivity to light to help them orientate themselves. It is when an animal leaves the sea floor ecent years is that a bee can "draw a flight map" and tell its hivemates where to find the honey

to swim in a vast world of three dimensions, or abandons a pedestrian life on land for the adventure of flight, that navigation by reference to cosmic forces and internal sensations becomes paramount. Then, for most creatures, it is the light of the sun by day and the gravitational pull of the earth by night as well as day that maintain them in their course. Even the jellyfish has its eyespots and weighted sacs, whereby in light or darkness it manages to keep near the surface of the sea.

To state it another way, animals navigate mainly by the light of a star and the pull of a planet, though quite differently from the aviator with his mechanical instruments and mathematical tables. When speed is attained, the friction and pressures of the medium through which an animal travels are generally also taken into account. Friction may be lessened by streamlining, and pressures are likewise reduced, but they are not eliminated. And pressures actually have their own value. An animal that is traveling at high speed and is twisting and turning needs to be constantly responsive to stresses inherent in its maneuvers. Clearly, the creature requires an apparatus that is sensitive to speed and sharpness of turn in order to achieve precise control. So we find numerous pressure organs over the face of a fish, lying in an intricate system of surface channels. They send to the brain an accurate reflection of the water stream flowing past the head.

In the air, the flight and navigating powers of bats and birds present both wonders and mysteries, but these warm-blooded creatures are at least large enough to accommodate organs of considerable complexity. It is when we come to the insects that we gasp in wonderment, for here we see equally exquisite mechanisms for flight and the control of flight compressed into almost unbelievably small space. We know most about certain flies, particularly *Muscina stabulans*, and the honeybee, for these are the insects that have been studied the most. And while it may take a somewhat detached point of view to see beauty in a buzzing fly, its speed, hairpin turns, and pin-point landings demonstrate the superb performance of an aerial gymnast.

Something of how a fly does it has been discovered recently by Dr. F. S. J. Hollick, who devised a wind tunnel and balance such as is used for the study of aircraft but on a scale adapted to the size of a fly. Air was blown in various ways past a captive fly, and its wingbeats and other movements were delicately recorded. One flight instrument uncovered was an airspeed indicator situated in the third joint of the antennae. As air pressure increases on the head of the insect, the antennae become more and more deflected at the third joint, and the strains so set up stimulate the tension-recording sense organ at the base. This in turn sets off the various reflex adjustments of posture appropriate to the speed in question. Just how important the speed indicator is and how it influences flight is hard to say. But it does suggest forcibly that the insect not only flies but feels itself in flight and that this is important to the flight operation.

Even more informative than the antennal airspeed indicator is the turn indicator. This is an organ long known but only recently understood. It is called the haltere. Readers of NATURAL HISTORY were introduced to the operation of this organ in an article by Dr. C. H. Curran, "How Flies Fly," in the February, 1948, issue. This article was based on the first successful high-speed motion pictures showing the action of the halteres in a Drone Fly. The fly has a pair of these, one on each side, below and slightly to the rear of the wing bases, and it will be recalled that their rapid vibration provides the fly with the equivalent of a gyroscopic indicator. If the flying insect goes off course or tends to go into a spin, strains are caused in the basal sense organs, and these strains set off stimuli that initiate reflex flight stability. Without this living gyroscope, the fly could not make its sharp turns and twists without going out of control. This use of the gyroscope principle by various kinds of flies seems to be unique in the animal kingdom.

So much for flight itself. When it comes to navigation it is the bee that holds the honors.

If you were told that a bee returning from a trip to get honey or pollen could "remember" how far it had traveled, what direction it had taken to get home, how good the supply was, and in the dark in the hive could "tell" the other bees just where to go to get some more, would you believe it? This is the story that has come out of Austria since the end of the war from Professor Karl von Frisch. It sounds like a tall story, so tall in fact that a scientist at the University of Cambridge found it impossible to believe and yet at the same time found it impossible to disbelieve a man of von Frisch's standing. So there was only one thing for him to do—go to Austria and see for himself. The result is that the truth of the story is confirmed, and by a man who had originally doubted it. Such is the way of science, and in consequence we now must completely revise our ideas of what goes on in some of the tiniest brains in the world.

If men, instead of bees, were doing these things, we would say that the finder remembers how far he had traveled and in what direction, and that he tells his companions about the distance and location of food on the return, by gestures or by speaking. But the finder returning to the hive, and to her aroused nestmates, are bees. How these things are retained by the bee, and how they are transmitted to the other bees, remains an unsolved problem. Bees do not learn their "language" as man learns his; rather, without any special process of learning, they seem to be capable of their "dances" on the comb and of reacting to the dancing of hivemates. But although we do not know as yet how these results are achieved, the facts that follow have been demonstrated with clarity.

When a worker bee discovers a large source of food, she "informs" the other workers in some way through her dance on the comb. The bees that are closest follow her in the dance, become excited, and then fly out in search of the food. This has been known for a good many years. Then it was noticed that there are two kinds of dances, the round dance and the waggle dance. If the food is less than 100 yards away, the bee performs the round dance. Somehow the round dance serves as a kind of signal to other bees to go out and search for food having the scent that the dancer acquired from the flower.

When distances become greater, this sort of searching could be a great waste of time and effort, but fortunately for the hive, the bees are able to avoid this by other resources of communication. The finders then start their waggle dances. This is much more complicated than the round dance. The bee runs across the middle of the cone, waggling her abdomen from side to side at a constant rate. This is merely part of the dance, and the whole dance is in the form of a figure eight, up the middle of the cone and down one side, up the middle and down the other side. The dance is repeated a number of times.

Now, what von Frisch and his skeptical visitor found was that by timing the dance with a stop watch, they themselves could tell roughly how far away the food supply was located, within 100 yards of being correct even when it was 5 miles away. If the food was between 100 and 200 yards from the hive, the dance was repeated about 10 times in 15 seconds. When it was 1000 meters away, the frequency of the dance dropped to between 4 or 5 in every 15 seconds. This aspect of the dance has two very useful results for the hive. In the first place it excites the near-by bees, which follow behind it. And the frequency of the waltz in some way tells them how far they must fly to find the food. The teacher says in effect, "It is dark in here; stay close behind and do this after me!"

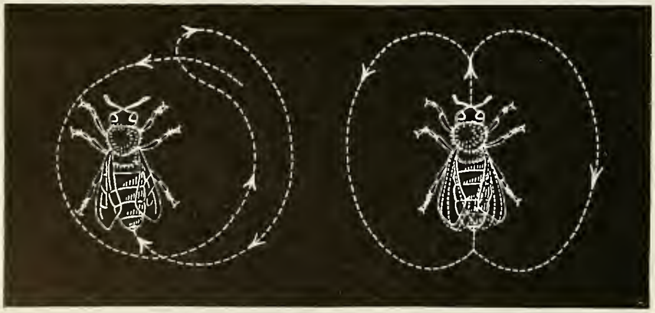
So much for the distance; what of the direction? Remember that the dance is performed in the dark on the vertical surface of a comb. The direction of the waggle-run across the center indicates the direction in which the food lies in relation to the position of the sun. If the waggle-run goes straight up the comb, the food is to be found by directly following the path toward the sun. If the run goes straight down the comb, it lies in the direction opposite to the sun. If the run goes to the right, the food is to be found to the right of the sun and at just such an angle as the run makes with the vertical line of the comb. And the same relationship holds on the left.

The dance accordingly tells the following bees both the distance and the direction, and as soon as the other bees have gained the information, off they go. If there is still food when they get there, they gather it, return to the hive, and in their turn perform the waggle dance. And so more and more bees become excited and go harvesting. When finally the food is all gone, the returning workers dance no more, and the hive quiets down.

The more you think about all this, the more remarkable it becomes. It is almost like map making and map reading. For the bee does not point out the actual direction of the food, anymore than a map actually points the way to New York. When the bee is moving straight up the cone, it means that the food supply lies in the direction of the sun, but it certainly does not mean that the sun or the food is overhead. So how is the information really conveyed? For when the dance is performed, it is in the darkness of the hive where the sun cannot be seen.

There are two forces that animals make use of to find their way in space. These are light and gravity. Even the jellyfish have little simple eyespots that tell them whether they are moving toward the light or away from it, and they have little weighted sacs that respond to the pull of gravity. All animals that move rapidly through air or water know the pull of the earth and the light from the sun. And what the bee does when she waggles up the middle of the cone is to substitute gravity for light, to substitute the line to the center of the earth for the line to the sun. This is something like what you do when you draw a map. You draw an arrow which represents the

After Karl von Frisch, Bees: Their Vision, Chemical Senses, and Language,
courtesy Cornell University Press



Round Dance Waggle Dance

direction of north, no matter how you turn the paper.

In some way the sense of gravity takes the place of light in whatever kind of mind the bee possesses, and the angle of the climb in relation to the straight pull downward of the force of gravity somehow is measured. Moreover, it is measured to an accuracy of about three degrees. As to how it is measured, we have as yet very little idea. In fact, one of the most puzzling things about the whole business is that the bee seems to have so little equipment with which to do it. The bee that has found the food takes measure in some way of the time or effort taken to get to it. Its senses record the direction of the flight home in relation to the position of the sun. It draws a map in the form of a dance, in which a line to the earth's center becomes a symbol for the line from the hive to the sun. And other bees following in the footsteps of the dance translate the movements and directions back from gravity to light and gain knowledge both of distance and direction. This is a far cry from our old idea of forced movements. We used to say that bees and other insects moved automatically and in a simple way in direct response to light or smell or some other stimulus, forced to move toward the light or away from it whether they wanted to or not.

The problem would be difficult enough if this were all. But it isn't. Outside the hive, the bees will give the distances and directions on a flat horizontal surface. The signaling bee then uses the actual line to the sun as the measuring line, and it uses the line of the waggle dance to point the real direction of the food. In complete darkness the bee can no longer do this, which is not surprising. What is surprising is that she can draw the sun line as long as a patch of sky can be seen, even if the sun is out of sight. And it has taken a very large number of experiments to discover more of what this means.

In the crucial experiments, von Frisch placed a "polaroid" screen over an opening in the top of a hive. As he rotated the screen into various positions, he saw that the dancing bees changed the line of their dance accordingly. This meant that they were sensitive to polarized light from the sky and could orientate themselves with regard to it, just as they could to the position of the sun itself. Now this complicates matters, for there is not much likelihood that the bees have any opportunity to perform the waggle dance horizontally within the hive. Yet the experiments do show a remarkable faculty for obtaining compass directions from polarized light, and the bees should have a use for it. And very recently the lowly ant has been shown to move in accordance with the direction of polarized light.

Natural polarized light outside is the light that passes from the sun and is reflected from the high sky at right angles to the sun down to the earth's surface. Such light rays are no longer scattered but are parallel, and if we could see them we would see a pattern of light in the sky, a pattern or zoning that the bees evidently do see. The bees are able to orientate themselves with relation to the sun even under a clouded sky so long as there is a patch of blue. When there is no blue, the bee must have unobstructed vision in the direction of the sun to detect its position. It is clear from von Frisch's experiments that bees depend greatly upon the polarized light of the sky for their orientation. But remember, the dance that follows does not give the angle of flight in relation to the polarized light; it still gives the flight angle relative to the position of the sun. The pattern of polarized light is used by the bee to locate the position of the sun, and the bearings are made in relation to that. And then, in the actual dance within the hive, it is translated on a vertical surface into a relationship with the plumb line of gravity.

Such is the way of science. We remove the veil in front of one mystery only to find a greater mystery lies behind.

Edwin Way Teale photo

Honeybees on apple blossoms

THE *Van*

< Camayura chief with his wife and child

Laboratorio da Fotoptica

Deep in the wilderness of the Upper Xingu River in Brazil, science is studying some of the world's last remaining primitives

By Edwin D. Neff

HARDLY a day's plane trip northwest of Rio de Janeiro, in the verdant wilderness of the Brazilian Matto Grosso, live some of the strangest people on earth—the Indian tribes of the Upper Xingu basin. Here, in daily practice, are fantastic customs dating back to the hazy origins of men in the New World, perhaps 25,000 years ago. Deep in these little-known forests are painted men, playing sacred flutes, practicing sorcery, believing that tribal gods created their ancestors from trees.

Few white men have seen these naked, brown-skinned savages, now vanishing from the face of the earth. Because they are hemmed in from the white man's world, and even from other tribes, by geographical barriers, the people of the Upper Xingu basin (pronounced SHING-goo) have been able to survive unchanged, unspoiled. Their homelands are a hidden world, fenced in by the hazardous rapids of unnavigable rivers.

Today, this picture is changing. Brazil, eager to open up its vast, rich interior, is building roads and settlements and airstrips. Inevitably, white men's diseases have reached the natives, and before long, these tribes will probably become extinct. Hardly more than 700 Indians remain in the Upper Xingu River basin. For this reason, Dr. Kalervo Oberg, an anthropologist backed by the Smithsonian Institution, the U. S. Department of State, and the Escola Livre de Sociología e Politica de São Paulo, has visited these tribes and others in Brazil every year during the dry season since 1946—writing what may be the final chapter in their history.

But before we tell you more about these vanishing tribes, little known and almost overlooked by the rest of the world, let's see why anthropologists go to so much trouble and often danger to study them. What can the world of jet planes, atom bombs, and electronic computers learn from men who still hunt with bows and arrows, live in grass houses, and believe in spirits? We must remember that human nature

▲ A TYPICAL VILLAGE of the Upper Xingu. The huts are made of saplings and grass.

hing Tribes

OF BRAZIL

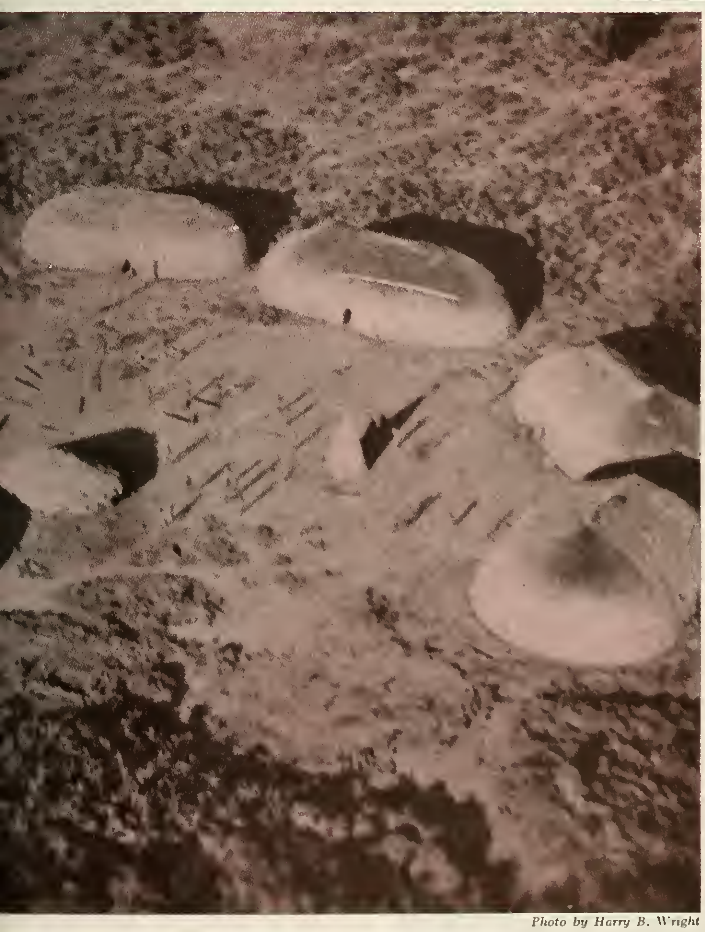


Photo by Harry B. Wright

of the larger ones house five to eight
es. There may be a large central

house containing ceremonial objects. This aerial view was taken on the Tuluene River

Photo by Harry B. Wright

▲ TWO GIRLS of the Tuluene River, after bathing. They wear no clothes any time

is far more complex than physics and mathematics. Man constantly perfects the weapons of war, for example, without discovering how to prevent war; and despite his brilliance in the physical sciences, he still does not understand himself.

Like the biologist who begins his studies with the one-celled plants and animals, the anthropologist begins with the simplest groups of people. South America is the only part of the New World where there are peoples still unspoiled by what we call civilization. And in these small, primitive groups a single scientist can observe the entire culture. He can see how these men have adjusted themselves to their natural environment and to their fellow men.

In addition, Dr. Oberg is trying to learn where the Upper Xingu groups relate to other aboriginal peoples of the New World and, even further afield, to the peoples of the Old World. He began his studies at the Jacarei airfield on the Tuluene River, deep in the interior of Brazil, the region known as the

Photo by Harry B. Wright

➤ TAKUNÍ, a Camayura, shooting fish with the bow and arrow

▲ A CAMAYURA GIRL, who will see many changes in her ancient homeland

Laboratorio da Fotoptica

Photo by Harry B. Wright

◄ THE WOMEN prepare a variety of dishes based on the products of a simple agricultural and hunting economy. The white men sometimes found gifts of cooked fish and terrapin distributed among their bedcovers

Matto Grosso. The airfield was built by the Roncador Xingu Expedition, spearhead of the Brazilian Government's efforts to open up the country's wild interior.

Here the Xingu River and its five great tributaries form a triangular basin enclosed between longitudes 52 and 55.5 West and latitudes 12 and 14 South. The basin is bounded on the south by the semiarid Planato do Matogrosense, on the east by the Serra do Roncador, and on the west by the Serra Formosa.

Within this basin, fortified by dense forests and scarcely navigable streams, Dr. Oberg found several tribes of truly primitive Indians, totaling 733. They were at peace with one another, but they united against their enemies, who threatened from all sides of the

Photo by Harry B. Wright

▲ A TRUMAÍ INDIAN making fire in the Upper Xingu country

basin. In a sense, they have discovered the working principles of the United Nations. They speak different languages but understand something of each other's tongues, and their culture is basically the same. There is plenty of room and plenty of resources for all. Tribal specializations in crafts result in constant trading among the different groups.

The Indians' wild and beautiful country is filled with eerie sights and sounds and smells. There are strange – and familiar – animals: tapirs, jaguars, plains deer, cougars, wild pigs, otters, anteaters, monkeys, parrots, macaws, toucans, hawks, eagles, buzzards, alligators, and terrapins. In late August, the flowering jacaranda trees turn the forests into a tropical garden. Mangabeira trees are heavy with plumlike fruit, and the timbo blossoms fill the air with a rich, narcotic perfume.

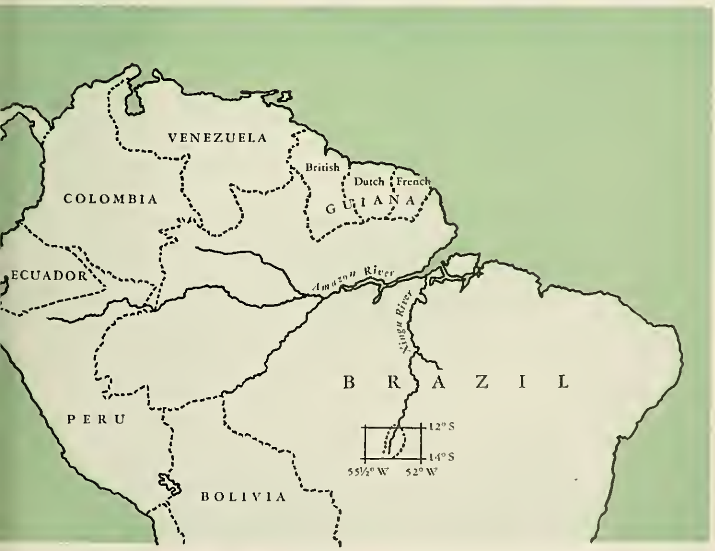
Wet and dry seasons are sharply marked. Beginning in September and continuing through April, there are almost daily thundershowers. But there is hardly any rain from May through August. During August and September, Indian fires clear the land for planting, and a constant haze hangs over the basin.

Dr. Oberg began his study of the northern Matto Grosso tribes at the start of the dry season in May of 1948, at the village of Tuatuari, near the Jacarei airfield. Since the basin Indians are similar in most respects, he selected the Camayuras for detailed study because they were the easiest to contact. As he stepped off the plane at the airfield, a naked Camayura approached him, touched his chest, and through an interpreter asked his name. Soon, Dr. Oberg's party was surrounded by 30 Camayuras—men, women, and children. They began opening the white men's shirts to feel the hair on their chests, running their hands through the visitors' pockets, and tying and untying shoelaces.

They were fascinated by "teeth that come out"—that is, dental plates. They asked endless questions about the family relationships of Dr. Oberg and his party and were deeply puzzled by the presence of a Japanese, who didn't seem to fit. Later, when they saw a picture of a Japanese in a magazine brought by Dr. Oberg, they decided it was the likeness of a brother to Oberg's Japanese student. The reason for the curiosity about the visitors' family relationships was the Camayura's kinship society. To know how to treat someone you must know his family ties.

Fathers and fathers-in-law are treated with great respect. Mothers-in-law may not be spoken to at all, except through another person. Brothers treat each other as equals. Fortunately, the Camayuras decided to treat Dr. Oberg's party as brothers.

That decision brought somewhat more intimacy than the scientists



had bargained for. Camayura children began jumping about on the white men's beds. (They were used to hammocks.) Camayura women brought bits of cooked fish and terrapin and distributed them among the bedcovers. (The visitors might get hungry in the night!) Sometimes a Camayura woman would offer Dr. Oberg the tribal *pièce de résistance*—a dainty cake of manioc flour. Then she would squat on her heels and watch his face for signs of appreciation. When the visitors gave the natives food, there was a noisy smacking of lips and appreciative grins. This was considered ordinary courtesy.

The visitors got no privacy at all. Natives wandered at will around the white men's quarters, examining everything and hoping for brown sugar and beads. Naked children scrambled over Dr. Oberg's lap while he struggled with his notes.

The first Camayura with which Dr. Oberg attempted to do business was Nilo, a sixteen-year-old boy. Nilo, though in many respects a slender reed for an anthropologist to lean upon, had at least been taught Portuguese and could act as interpreter and guide. Unhappily, and despite lavish payments of brown sugar, Nilo hated interviews. When Dr. Oberg tried to pin him down on a bit of tribal information, Nilo would grunt, "Look, guy, I told you all that the day before."

Once, someone foolishly loaned Nilo a rifle, and he accidentally shot another native boy. Although the lad survived, Nilo was in bad odor with his tribe. Further, he had been caught stealing sugar. His father decided he was immature and sequestered him behind a screen in the family hut to whittle arrows and learn to play the sacred flute.

The incident was typical of what Dr. Oberg found at the Jacarei airfield—a perplexing mixture of old and new cultures. At this point of contact between men of different worlds, Indians of ancient culture could get penicillin for their ills, while airplanes roared above dugout canoes and radio newscasts from Rio, New York, and London competed with native gossip.

Back in the forests, Dr. Oberg found the Camayuras living in villages of grass houses, elliptical in shape, and built around a larger, central house where the sacred objects were kept. As a partial defense against enemies, the villages were located on narrow streams almost covered by overhanging vegetation and hence difficult to approach by canoe. Thus invaders usually approached overland, spotting the Camayuras by smoke from the village fires. When the Camayuras became aware of enemies, they abandoned their villages, retreated into the forest, and hung their hammocks among the trees.

Camayura villages are only semipermanent. When the soil near by is exhausted by crops and the fishing depleted, the Indians move to new sites and plant again. But they continue to return to the old homesteads for harvesting until the new crops begin to bear.

Home building is a community affair. Everybody helps his neighbor cut saplings, collect and bundle the tall grass, and erect the house. Afterward, there is feasting. The houses vary in size, the larger ones being roomy enough for five to eight families. The wife's hammock is strung nearest the hut floor, with her husband's directly overhead. The children's hammocks are near by. On the floor, beneath the wife's hammock, a fire is built to ward off insects and provide heat. She is expected to keep it going all night. Since the Camayuras wear no clothes, there are frequent body burns caused by sparks striking the sleepers.

The Camayuras' chief crops are manioc, sweet potatoes, maize, and peanuts. Crops are planted at the start of the rainy season and harvested in March. The women spend most of their time preparing meal and flour from manioc roots, which must be carefully processed to eliminate a deadly poison, prussic acid.

The Indians never tire of talking about manioc. They believe it was the gift of the god Mavutsine, creator of the Camayuras, who warned them to guard it carefully from the forest animals. The ancestral Camayuras were careless, however, and the original, beautiful green field of manioc was all but trampled out by deer. Only a tiny sprout remained, and from this grew all future manioc. None was so beautiful as the first, however, and to this day the Camayuras hate deer.

Piquia fruit (resembling avocado), cotton (for hammocks), and urucú* are also grown. The latter provides seeds with a brilliant red pigment, which is mixed with oil or water and smeared over the body in decorative, geometrical designs. Tobacco, another crop, is believed to have magical properties and may be smoked only by mature men.

Aside from the plant staples, the Camayuras' chief food is fish. (Meat is rarely eaten.) They use one of the most unusual methods of fishing known. All the fancy rods, reels, and multicolored flies of modern sportsmen are clumsy claptrap beside Camayura methods. For these primitive men use a drug to stupify fish, rendering them so helpless they can be picked out of the water by hand or easily shot with bow and arrow as they flounder near the surface.†

The drug is rotenone and is contained in the sap of the timbo vines, which grow wild near the jungle streams. The vines are gathered in bundles and tied to crossed stakes driven into the bed of a stream or pond so that the bundle is just above the surface of the water. Indians then beat the bundles with sticks for about two hours and spread the sap by jumping up and down in the water.

Within about two hours, as the drug begins to take effect, the fish surface, gasping for air. A great shout goes up, and archers, erect in the bows of canoes or poised like statues along the shore, begin to shoot. There are cheers for successful marksmanship and good-natured boos for misses. By nightfall, the fish are so drugged they can easily be scooped by hand into baskets.

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* It is possible that urucú is not actually cultivated but left standing after other trees have been cleared away.—Ed.

† This practice may have been borrowed from neighboring tribes in recent times. Von den Steinen did not find it in this area in 1884.—Ed.

Photo by Harry B. Wright

▲ **Fine physiques**, strengthened by a natural life in the wilderness, may prove no match for the diseases of civilization. Camayura wrestling

▼ **Enormous flutes**, several feet long, are important ceremonial instruments among the Camayuras

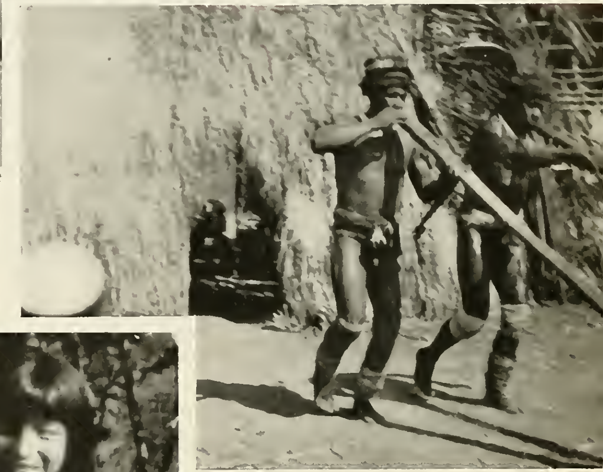


Photo by Harry B. Wright

Photo by Harry B. Wright

▲ **Owing** to the unnavigable rivers that protect their domain, these gentle "savages" have seen few white persons. The Brazilian Government has kept adventurers and unscrupulous persons away from the Camayuras lest exploitation degrade them

Camayuras also eat terrapin and terrapin eggs. The latter are hunted at dawn throughout August and September, the egg-laying season. Since the eggs are rich in oil, the Indians are sleek and fat during these months. The terrapin are caught barehanded by swimmers who stalk them in the rivers, seizing the animals by their tails as they dive. The terrapin may be sliced up and boiled or roasted alive, back-down on the coals.

Hardly less strange than their fishing technique are the Camayuras' superstitions. They believe that their ancestors were made from *Camiuva* trees by the tribal god Mavutsine, who carved a statue of a woman, blew cigar smoke over her, and stroked her with his hand to bring her to life. Then he made the sun and the moon and all the friendly tribes of the Upper Xingu. The moon, however, turned out to be a mistake, for it created the enemies of the Xingu men.

Mavutsine also made the first *jakui*, or sacred flutes, which still figure in the ceremonies. The flutes are cane, 36 inches long, and 3 inches in diameter. They have a deep, resonant tone, which the Camayuras believe promotes good fishing. Oddly, these flutes may not be looked upon by women. A woman who looks at one, even though by accident, is subject to gang assault. Dr. Oberg could find no explanation for this, no precedent, and no mention of it in other writings about South American tribes.

Shamanism, the art of sorcery and healing, is another curious Camayura custom. They believe it was taught their ancestors by Bem-tevi, the yellow-breasted flycatcher. Shamanism enables a man to cure another's illness or to bring vengeance upon his enemies. Sickness, according to these natives, is caused by the injection of foreign objects into the body by an enemy. Healing results when these objects are removed by the shaman. Any male adult becomes a shaman after serious illness, but only a few have the gift of healing. When a man becomes ill, his father or another old man initiates him into shamanism. The pair smoke tobacco until the patient falls into a trance. Tobacco is believed to have the power to summon spirits, Mama'ē, with whose help the shaman sucks out the foreign objects from the patient's body. If the patient recovers, he becomes a shaman, with the right to smoke. Women never smoke and never become shamans.

Contrasting sharply with the clean and friendly Camayura were the surly, disillusioned Nambicuara Indians, whom Dr. Oberg found to the west of the Xingu. To reach the Nambicuara, Oberg's party had to take a 400-mile truck journey from Cuiabá, capital of the Matto Grosso, to Utiarity. Since gasoline sells for $1.00 a gallon in this region, Dr. Oberg was lucky to be able to share expenses with a party of about 15, including 2 missionaries on their way to convert the Indians.

From Cuiabá to Porto Velho on the Madeira River, a government telegraph line cuts a narrow corridor through the vast, unknown territory of northwestern Matto Grosso. Along this line, the government has set up telegraph stations and a makeshift road past Utiarity to Burity. Beyond, the road is hardly more than a path. Since 1912, when the telegraph line was completed, the corridor has been a trail for venturous travelers seeking gold, diamonds, rubber, and Indian souls.

Most of these adventurers were shoestring operators with second-hand trucks and scanty supplies. They planned badly. They hired Indians at slave wages and deserted when food ran out. Worse, the Indians then became infected with venereal and other diseases against which they had no resistance. These exploitations have reduced the eastern Nambicuara to hardly more than 100, and they are split into little, nomadic bands. They are sullen, resentful, and suspicious of whites. They realize that white men are richer than they and that competition is impossible. They also realize that white men brought the diseases that are killing them off.

Dr. Oberg made his first contact with the Nambicuara at Utiarity after an uncomfortable journey over ferry crossings, hazardous bridges, and dry, sparsely-grown plateaus. He had supposed he would have to go far beyond Utiarity to locate the Nambicuara, and he borrowed a pack train of mules and oxen from the missionaries. But a band of about eighteen Nambicuara suddenly appeared in the village to get medical treatment for one of their men who had running sores.

He found them a miserable group; they seldom bathe, and they sleep on the ground instead of in hammocks. Their bodies were covered with particles of decayed meat and fish. They suffered from internal parasites, and their stomachs were painfully distended. During the dry season each year, they are lean and hungry, for by the end of June they have eaten the few crops they plant. They survive only by exploiting all resources of the area.

The Nambicuara are nomadic hunters and collectors. In addition, they plant manioc, maize, and beans. Except when only the men go after large game, the whole family hunts. These "hunting" trips are actually collecting expeditions, for the hungry Indians seize anything edible. The husband walks in front, followed by the wife with a burden basket on her back and an infant strapped to her hip. The other children bring up the rear. The family collects fruit, nuts, snakes, lizards, insects, wild honey, grubs or larvae, and on the way home, firewood.

The men hunt in bands for wild pig, surrounding the animals in the brush through skillful teamwork and shooting them with arrows. Few escape. The catch is divided up according to the size of the individual hunter's family, and all parts of the pig are eaten. Anacondas and alligators also are hunted, the latter in water holes into which the Indians shoot blind until the snake ceases to struggle. They poke about under logs with their bare feet for hidden alligators. Luckily, the Indians are quick-footed enough not to get bitten.

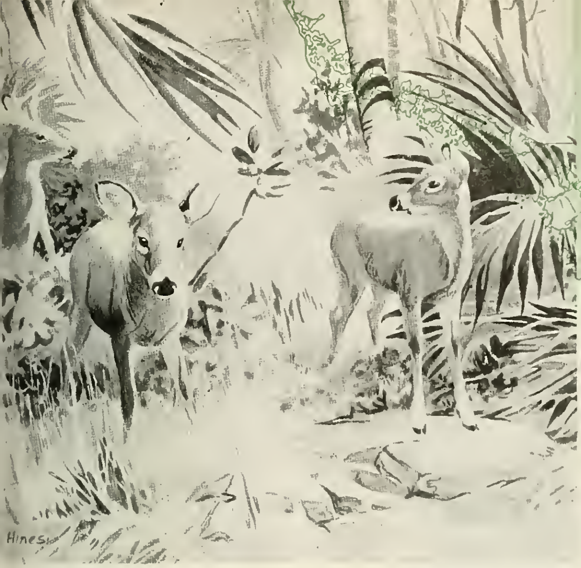
The Nambicuara are constantly at war with hostile tribes to the north. Their chieftains prepare the men for war by taking them into the forest and convincing them the men to the north are "bad" and must be killed. War chants and the manufacture of clubs and arrows follow, and on the night before the attack, the warriors paint their bodies with latex sap and red urucú. Curiously, they stuff leaves into holes in the ground to prevent their war chants from "leaking" to the enemy. They also burn leaves and the skins of anteaters and toads, hoping the smoke will blind enemy scouts and stupefy the near-by enemy villagers.

When the attack begins, the chieftain remains behind while the younger men raid the village. Loot is carried back to the waiting chieftains, who thus have a continuing motive for promoting war.

As we noted, the Nambicuara have an entirely different attitude toward white men from the Camayura. Their hostility is partly due to their more frequent contact with whites and partly to the different motives of the whites with whom the two groups of Indians came in contact. The Brazilian Government has kept adventurers and unscrupulous persons away from the Camayura and has maintained a friendly policy toward them.

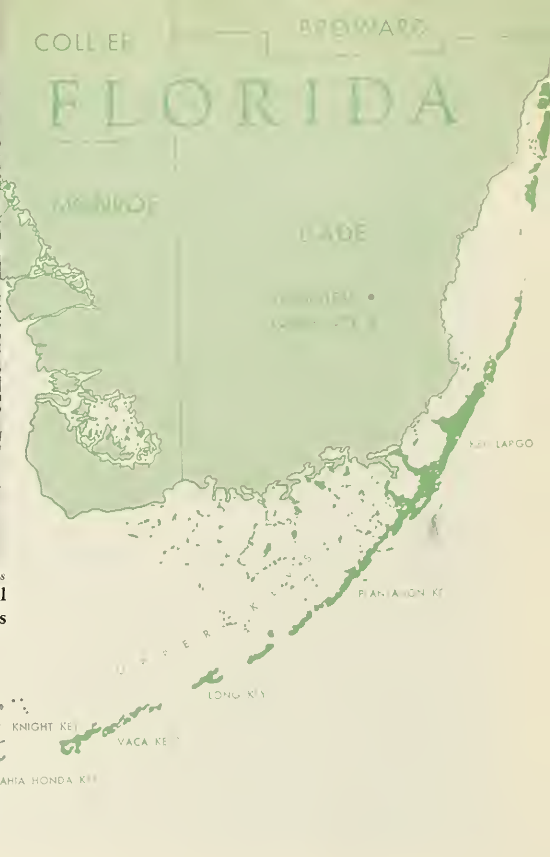
Without this protection, the Nambicuara were overwhelmed in their collision with the advanced technology and greed of white men. Very much the same thing, we must recall, happened to our own North American Indians. And to cite an extreme example, the Marquesans of the South Sea Islands were so crushed by European culture introduced by the French in the last century that they even ceased to breed and nearly died out.

The lessons these primitives can teach us, anthropologists believe, could profitably be studied by our Government before it undertakes to introduce American technology to less advanced peoples under the Point IV program. The Russians are hopefully waiting for us to repeat old mistakes.



Drawing by Bob Hines

▲ **Real estate development**, gunners, and speeding cars will wipe out the last of Florida's little Key Deer unless a sanctuary is established at once



Can We Save the Key Deer?

These unique "toy" deer, no bigger than a large dog, face final extinction in their native Florida Keys unless action is taken at once to save them

By Robert P. Allen

Research Associate, National Audubon Society

SOME years ago, in a restaurant in Key West, where Spanish yellow rice, *boyos,* and turtle steak were a new and pleasant experience, I was astonished at the diminutive size of the mounted deer heads displayed here and there on the walls. They seemed too small to be real.

My companion explained, rather casually I thought, that these were heads of a little deer that still inhabited certain of the Lower Florida Keys. The eyes, he went on, were the normal size supplied to taxidermists, but quite obviously they were far too large for these tiny heads. Even the antlers were miniatures.

It was my first trip to the Florida Keys, and by the time we reached the *boyos* and the toy deer, I was completely surfeited with extraordinary and unheard-of natural wonders. Many of them were difficult to believe. It was possible to accept the region as subtropical, but the improbable combination of crocodiles, pink spoonbills, pirate gold, rock beauties, butterfly fish, panthers—and now toy deer—seemed like too much to swallow in one day. After all, this was Florida, U. S. A., not the Great Barrier Reef on the other side of the globe. Or Africa, or the Land of the Golden Fleece.

Next day I looked at some of the heads more closely and found them to be real enough. I also talked with local people, who told me that the tiny animals "have always been

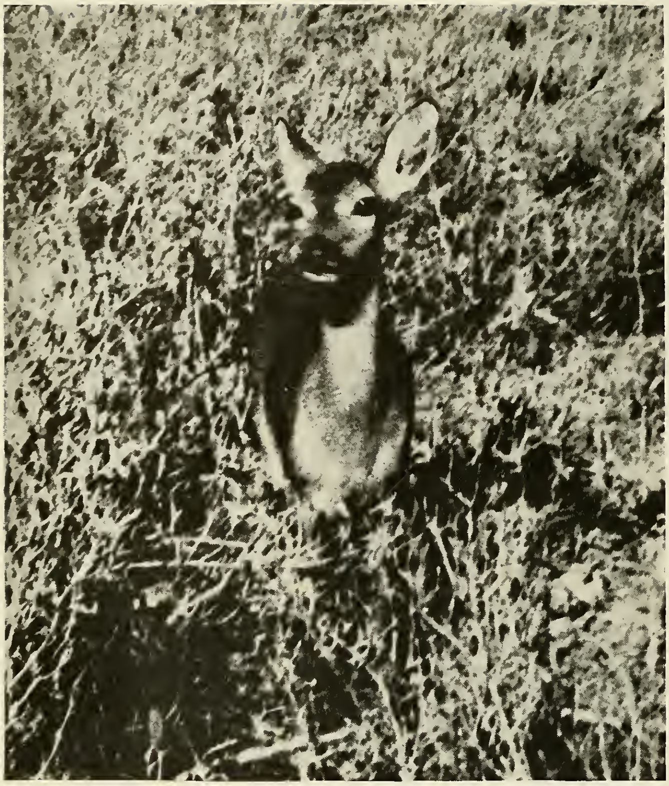


Photo by A. Ernest Sawyer, courtesy Fish and Wildlife Service

▲ SO FAR AS NATURAL HISTORY Magazine could ascertain, this represents the only time that someone shot Bambi's little cousin with a camera instead of a gun. There may be no more than 30 of the appealing little animals left

here," although the range was then limited to a few keys in the vicinity of Big Pine Key, 20 miles northeast of Key West. Apparently the deer were hunted in and out of season and were greatly reduced in numbers. We visited their habitat on Big Pine, and after tramping through the pine and palmetto, the mosquitoes and heat, without seeing anything except a few small tracks in the mud of the road, we could agree as to their apparent rarity and even wonder that these miniature deer survived at all. Fires had swept through the slash pine (*Pinus caribaea*) not too long before, leaving a floor of bare, badly eroded rock and wide areas of blackened trunks. There were adjacent ridges of tropical buttonwood *(Conocarpus erecta)* that were free of fire damage, as were the adjacent fringes of black and red mangroves, but at first glance it seemed a poor environment. At several places on the road there were eloquent little heaps of empty shotgun shells, some of them not even weathered.

During the next few years, an effort was made by the National Audubon Society to prevent the shooting of the deer through the cooperation of landowners and state authorities. Educational work was undertaken in Key West. A bill was passed by the State Legislature giving temporary protection, and it was later replaced by a Game Commission regulation. Then came World War II, and our concern for the deer, along with many other projects of a similar nature, was put aside. Only today, a dozen years after our first interest in their predicament, are definite steps being taken to learn more of these unusual animals and to preserve them and their habitat.

What does the Key Deer look like, and what are these little animals doing in this isolated and seemingly unfavorable environment? Many people have asked these questions.

The Key Deer *(Odocoileus virginianus clavium)* is the smallest of the several races of white-tailed deer. There are some who believe that it is sufficiently different to be placed in a separate category as a distinct species, but this is a problem for the systematists and is only of academic interest to the conservationist. The fact that it is unlike our other native deer on so many counts, and that its complete destruction would mean the extinction of a unique and irreplaceable form, is more than enough to enlist our sympathy and our strong interest in its survival.

In general appearance the Key Deer looks like a diminutive whitetail, except that its proportions never approach the magnificent, as in large bucks of the Michigan or Pennsylvania forests. It is a dwarflike animal. The largest bucks, which have been reported to reach a maximum weight of 55 pounds, with an average of something under 50 pounds, are built along miniature and almost elfish lines. They are about the stature of a big dog. Their pocket size, in fact, is their greatest appeal. That such handsome and delicate little creatures should be cruelly and needlessly killed, sometimes with a hand ax as they bravely attempt to escape the hounds by swimming, is enough to stir the most disinterested citizen to action. By comparison, the 300-pound whitetail bucks of the northern forests are not only giants fully six times as large as the biggest Key Deer, but one feels that they are stronger, more capable animals, better able to take care of themselves. The little does are proportionately smaller, and one individual that had been killed by a car on the Overseas Highway on Big Pine Key weighed only 35 pounds, which is probably close to average for adult females. I helped Jack Watson, of the U. S. Fish and Wildlife Service, skin this specimen, and she was an old deer with brown-stained, well-worn teeth. She had an over-all length of only 38 inches and measured 26 inches high at the shoulder.

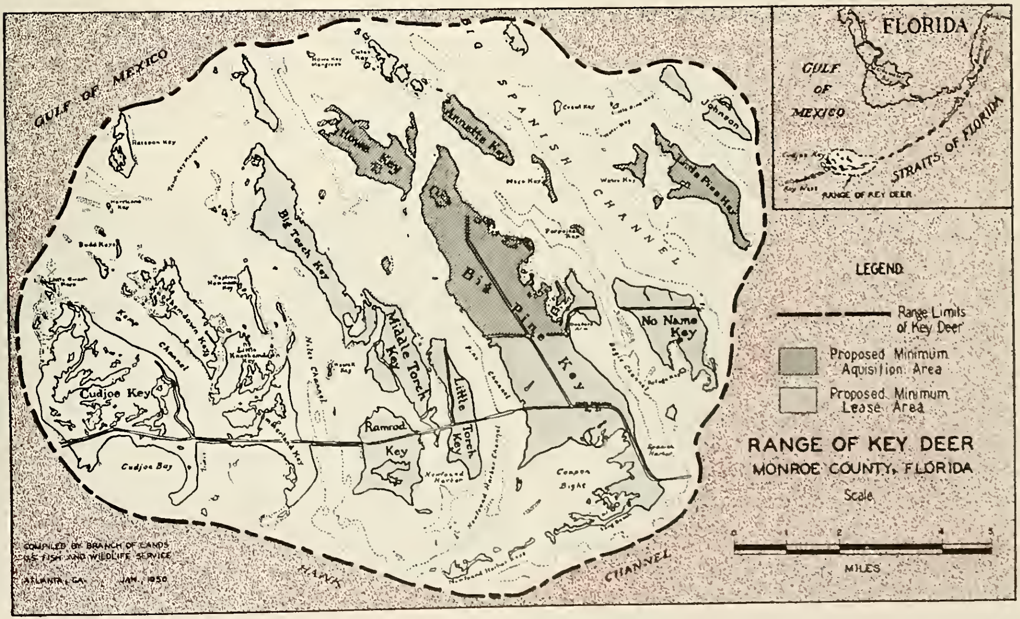
There are several possible explanations as to how these pygmy deer happen to occur in this isolated spot. The most convincing is the theory that they went there with the original fauna of the postglacial period, perhaps as normal-sized deer, evolving to their present size and character in that insular environment. During the Pleistocene period, the melting ice of the several interglacial stages raised the water level of the oceans, bays, and gulfs. It is believed that during the last or Peorian interglacial stage, the so-called Pamlico Sea covered southern Florida up to about the present 25-foot contour. This means that all of southern Florida as we know it today was under water as far up the peninsula as the Caloosahatchee basin.

During the last or Wisconsin glacial period which followed there was a drastic lowering of water levels, perhaps to as much as 20 feet or more below present levels. As a result, there was a long passage of time during which the Florida mainland of today was joined to the entire string of keys by a land bridge. Florida Bay was a dry lowland, traced with irregular estuaries. Deer passed easily from the mainland to almost any point on the keys. As the water level gradually returned to the present shore line, deer and other animals were probably cut off and eventually isolated.

There are marked differences between the Upper and Lower Keys. The former—the keys closest to the mainland—were once a living coral reef, and the present heights of land were once two fathoms or more beneath the sea. The limestone formation of these keys is unique, as is the dense growth of mahoganies, gumbo limbos, wild tamarinds, and other tropical hardwoods. Much of the hammock, however, has long since been destroyed to make room for plantations of pineapples, tomatoes, and other crops, and is still giving way to provide space for tourist cabins, lunch stands, and winter cottages.

The Lower Keys, from Big Pine to the Marquesas, are built on a formation of Miami oölite. This is identical with that which extends beneath Florida Bay and across a portion of Monroe County on the mainland, across all of Dade County and a portion of Broward. These keys are simply the higher areas of land that remained above the sea after the fluctuating levels began to rise toward their present height. On them only limited patches of hardwood hammock remain, most of the larger keys being covered with slash pine and palmetto.

The isolation of the Upper and Lower Keys from the mainland and from each other is fairly apparent. The flora of the upper group is chiefly Bahaman, while that of the lower group has much in common with the mainland in the pinelands around Homestead and Florida City, although West Indian and particularly Cuban plants are not uncommon. Once the sea shut off escape routes from these two regions, each developed its own peculiar characteristics. Deer trapped on the Lower Keys were cut off by Bahia Honda Channel and by the wide stretch of open water lying between the Bahia Honda group of keys and Knight Key, at the southwest extremity of the Upper Keys. Key Vaca, Long Key, and other

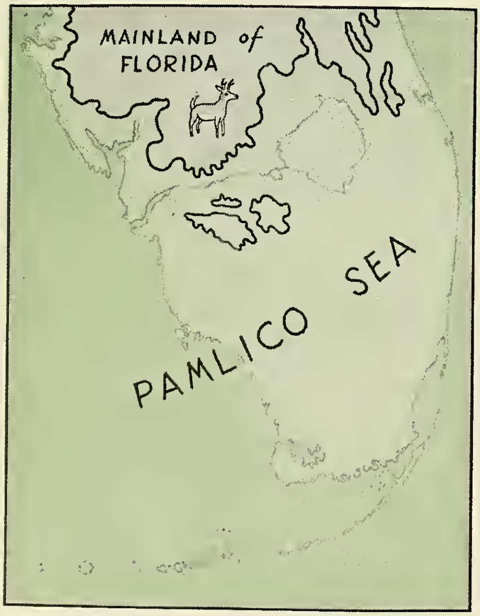

GULF OF MEXICO
Big Spanish Channel
Johnson
Howe Key
Annette Key
Little Pine Key
Big Torch Key
Big Pine Key
Middle Torch Key
Little Torch Key
Ramrod Key
No Name Key
Cudjoe Key
Cudjoe Bay
Kemp Channel
Summerland Key
Niles Channel
Coupon Bight
Raccoon Key
Budd Keys
Little Knockemdown Key
Newfound Harbor
Hawk Channel
FLORIDA
GULF OF MEXICO
STRAITS OF FLORIDA
Key West
RANGE OF KEY DEER
LEGEND
Range Limits of Key Deer
Proposed Minimum Aquisition Area
Proposed Minimum Lease Area
RANGE OF KEY DEER
MONROE COUNTY, FLORIDA
Scale
0 1 2 4 5
MILES
COMPILED BY BRANCH OF LANDS
U.S. FISH AND WILDLIFE SERVICE
ATLANTA, GA. JAN., 1950

more or less isolated islands in the upper group may have been shut off also, so that they too could have developed variant races of deer, as they did, to our knowledge, develop subspecific forms of the raccoon. However, there are no records. Key Largo provided a suitable habitat, but there was probably a tendency for the deer on this key to mingle with whitetails from the near-by mainland, so that a variant may never have developed. In witness of this, there are a few deer on Key Largo today that appear to be identical with the mainland race.

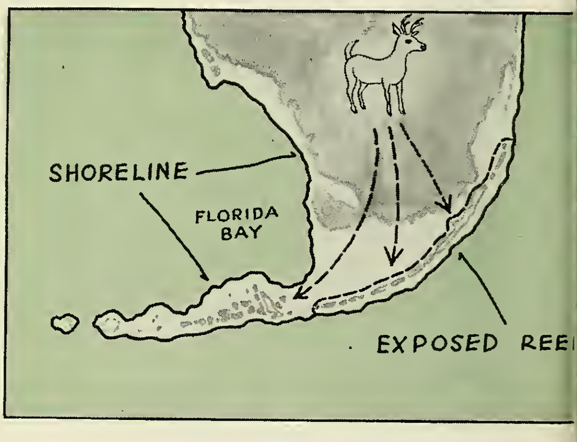
In the earliest times of man's occupancy, hunting pressure was apparently heavier on the Lower Keys than on the upper group. Hernando d'Escalante Fontaneda, the Spanish youth who was cast ashore on the keys in 1545 and lived among the savage Calusas for seventeen years, spoke in his *Memoirs* of "many deer" and mentioned the Indian settlement on the "Islands of Cuchiyaga," which is interpreted as meaning the Lower Keys. The botanist J. K. Small wrote, "On the lower Florida Keys, where game abounded, man left his mark . . . The upper Florida Keys did not offer a hunting-ground for the red man or much vegetation in the way of subsistence, so he passed them by —and their hammocks still remain to show his little interest in those islands." There are a few kitchen middens on Key Largo and Plantation Key, but these could have been merely casual camping places for Calusas on fishing expeditions. It is well known that the aborigines set fire to hammocks to facilitate their primitive means of hunting. As with the Everglade Keys, probably the larger of the Lower Keys were once covered with hardwood hammocks, similar to those that can still be seen on upper Key Largo and on Plantation Key. Successive fires set by Indian hunters destroyed the humus and exposed the honeycombed rock, and the elements did the rest. Hardwoods were finished. Only the relatively fireproof slash or Caribbean pine and the saw palmetto were able to thrive. It is in this habitat, surrounded by fringes of buttonwood and mangrove forest, that the remnants of the little Key Deer survive today.

It has been suggested that these pygmy deer may have been introduced from the West Indies by settlers, but this appears doubtful. Columbus found small deer on San Salvador, but the native deer of Cuba is a larger animal than the Key Deer. And it cannot be overlooked that Fontaneda found deer numerous, apparently on the Lower Keys, in the mid-sixteenth century, and there were no white settlers until much later. It seems more likely that this diminutive race has survived here since early times, attaining their present stature and characteristics through the slow and devious processes of natural selection.

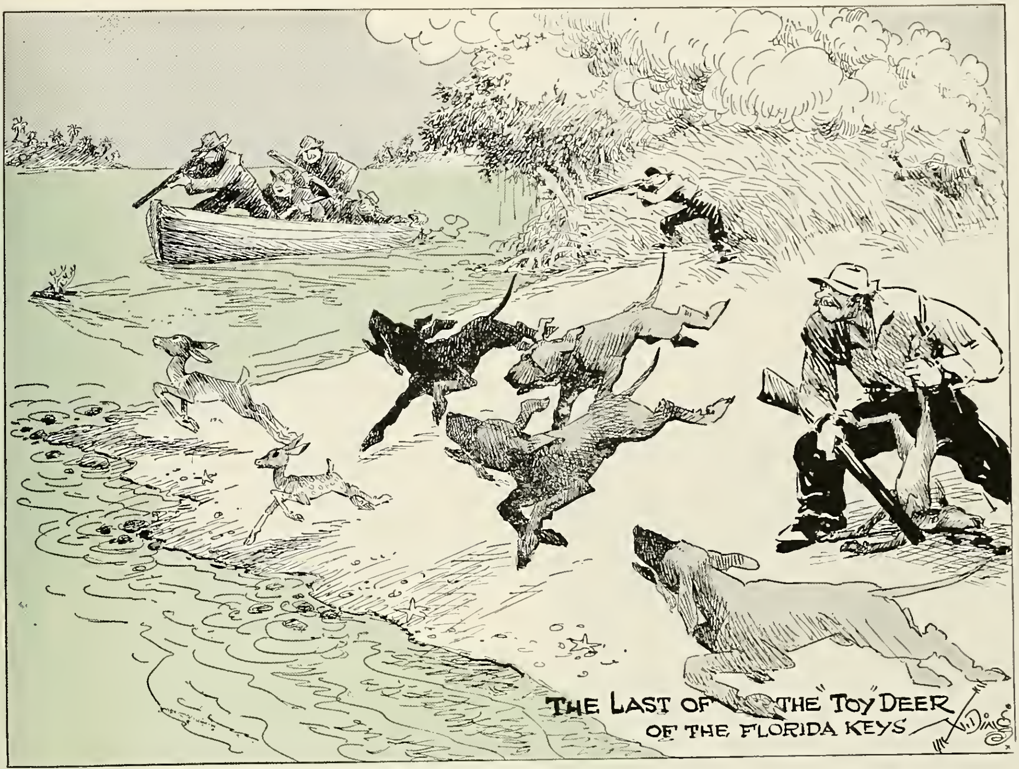
It also seems likely that these little animals would not have needed many special adjustments to live in this environment. Last summer Jack Watson found a great many water holes, fresh enough to drink from if you are not particular about a strong algal flavor, and fresh enough to support cattails and saw grass. There were also a surprising number of alligators—the only examples of this reptile south of the Everglades. (The salt-water habitat of Florida Bay and the Upper Keys is not the U. S. home of the alligator but of the American crocodile.) Evidently these tiny deer have survived in that



◀ During the last or Peorian interglacial stage, water from the melting ice sheet raised the sea level so that Florida was awash as shown here



▼ Later the sea level was drastically lowered during the Wisconsin glacial period as shown here. The sea fell perhaps 20 feet or more below the present level. Islands were joined, and the ancestors of the Key Deer were able to wander to almost any point in the keys


THE LAST OF THE "TOY" DEER OF THE FLORIDA KEYS
Ding

▲ A CHALLENGE to the conservation-minded public, drawn by the well-known cartoonist Ding Darling

environment for many thousands of years and continue to do so, even after the heedless shooting of the last two or three generations. That they are now in danger of extinction is not due to the inadequacy of their habitat. It is the result of shooting, running with dogs, losses on the Overseas Highway where a steady toll is taken by speeding cars, and the ever-present threats of fire and expanding real estate developments.

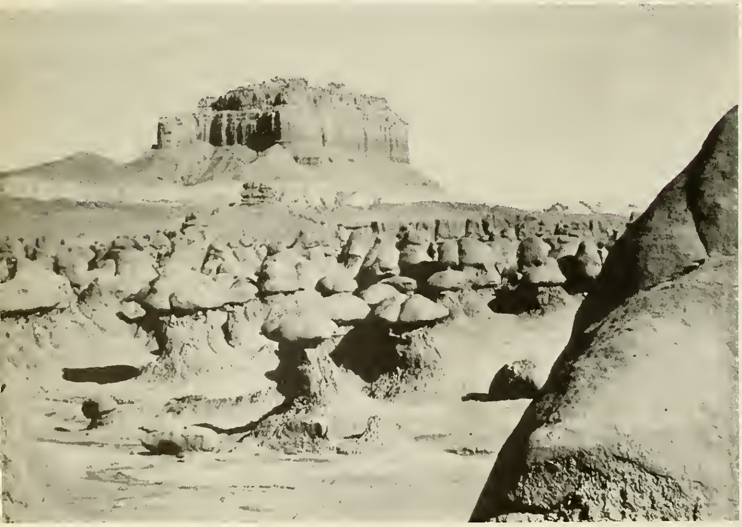
There may be no more than 30 of these toy deer alive today, but there is still a chance of saving them. Wide publicity of their plight, in recent months, has aroused public opinion in defense of the Key Deer. A concerted effort is now under way to set aside a suitable area as a federal refuge for this handsome, rare, and exceedingly interesting example of the native wildlife that is a valuable heritage of this land over which we have taken dominion.

Many organizations, agencies, and individuals have taken a hand in this endeavor. The U. S. Fish and Wildlife Service has provided effective warden patrol and is prepared to administer the proposed refuge. The Florida Game and Fresh Water Fish Commission, the Florida Wildlife Federation, the Monroe County Audubon Society, the National Audubon Society, and a number of others are also interested. Allen Corson, Conservation Editor of the *Miami Herald*, put on a campaign asking readers to express their views, and the response was overwhelmingly in favor of a federal refuge for the Key Deer. Congressman Charles E. Bennett of Jacksonville, during the last session of Congress, introduced a bill—H.R. 7524—the passage of which, along with companion bill S. 3286, introduced by Senator Claude Pepper, would authorize acquisition of needed lands within the Key Deer range. The House bill passed, but the Senate bill failed to survive committee consideration. It will be reintroduced in the 82nd Congress.

This tiny animal was a native of the Keys for some thousands of years before the arrival of the white man. It is a beautiful creature, with a gentle and appealing character. It is a living and attractive part of the scenery, more a part of Florida than the introduced flamingos at Hialeah Racetrack or the lush hotels that crowd Miami Beach. It belongs. If it is not provided for and protected from ignorant and irresponsible people who would slaughter the last member of its race, its passing will be on all our heads. Every conservationist should make a personal effort on behalf of this deserving and seriously threatened animal. Write your representatives in Congress urging them to support the passage of the bill to provide refuge for the Key Deer. Help save this vanishing American!

▲ WHEN YOU stand at the foot of this big fellow, you tend to feel a bit embarrassed beneath his stern and somewhat suspicious gaze

▼ WILD HORSE BUTTE, viewed across a small section of the Valley of the Goblins



The VALLEY of the GOBLINS

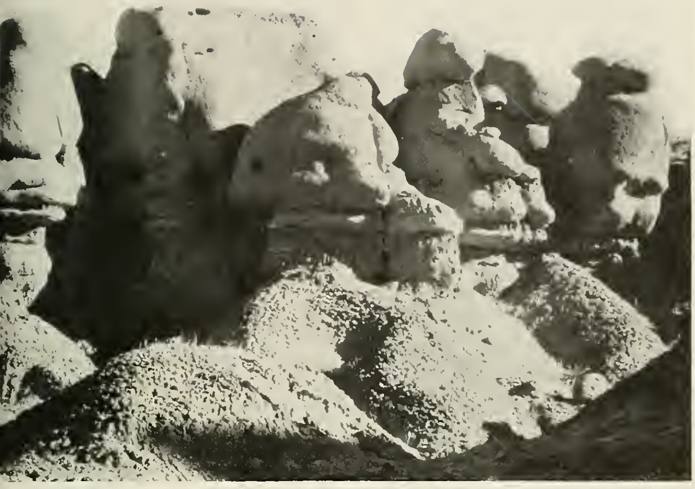
Adventure beckoned from Back of Beyond and led the author over a difficult trail to this newly discovered wonder in Utah—a "real" fairyland, revealed to the public for the first time in these pictures

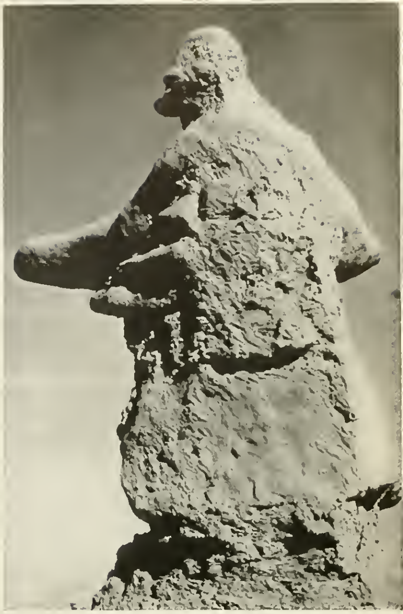
By HELEN C. MANZER

Photographs by the author

SINCE the discovery of America, people have been exploring every nook and cranny of this great continent. It may come as a surprise to learn, therefore, that even yet there are places into which explorations have made little if any penetration. Such a place is the Valley of the Goblins. Have you ever heard of this valley before? If so, you are among a fortunate group of five or six persons in the United States, for the Valley of the Goblins appears on no map, is on no highway, and has no trails leading to it.

Our acquaintance with this valley came about through sheer accident. My husband and I love the West, especially Utah, and more particularly that great area in the southeastern part of Utah where there are no highways. If you look at a map, you will see that in this region, hundreds of square miles in extent, such roads as do exist are of dirt, and the would-be traveler is warned about flash floods and quicksand. And because he will be many miles from the nearest habitation, he is

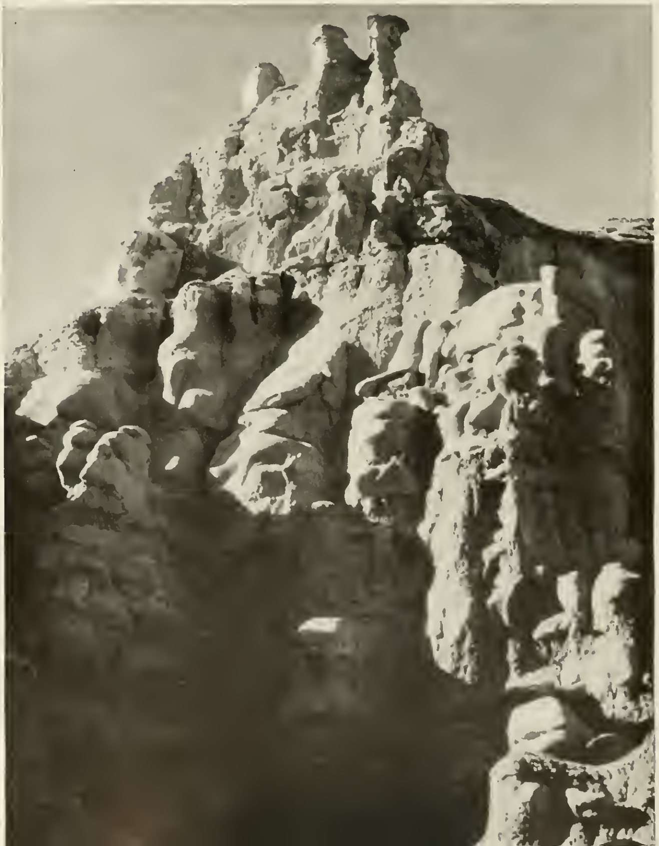




▲ "FRIEND OR FOE?" this goblin seems to ask

▲ THE MASSIVE FIGURES seem to take on animation as the oblique light emphasizes the frowns and smiles on their faces

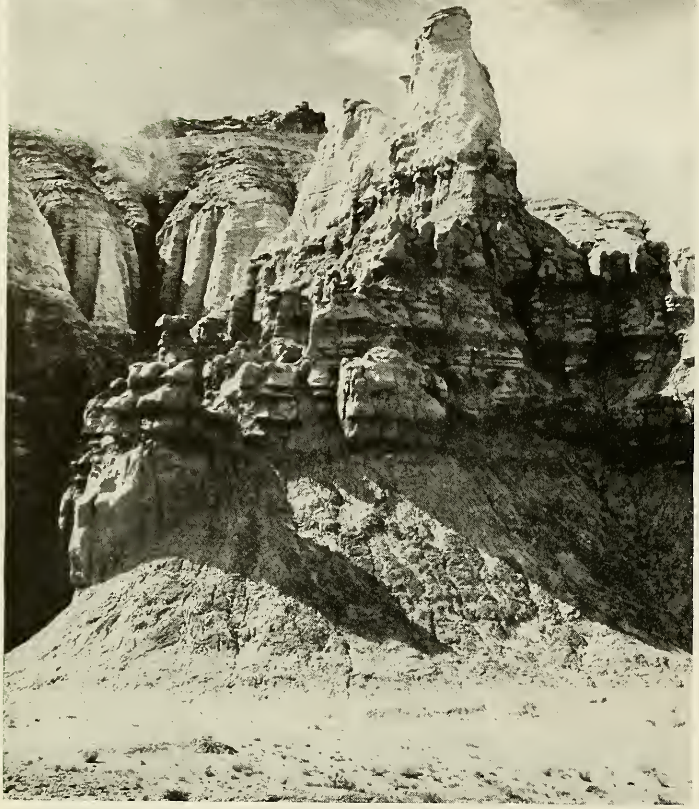
▼ FANTASTIC SHAPES resembling cathedrals and turreted castles have been carved in the lighter-colored sandstone at the upper rim of the valley



also urged to carry supplementary amounts of gasoline, water, and even food. Far from arousing fear, these descriptions and the implied hazards stimulated our imagination concerning the treasures of adventure and photography that must lie in that great area beyond the highway. We therefore set out by car to get as close as we could to this forbidding land.

It was during an overnight stop at the small, isolated town of Hanksville that we first heard mention of the Valley of the Goblins. We spent the evening in conversation with a group of local residents, and talk centered around the spectacular rocks in the region. One of the men in the party casually mentioned the Valley of the Goblins as a place where, he had heard, many fine specimens could be found. Much to our surprise, none of the other local residents in our party seemed concerned with the location of the valley, so the subject changed.

But the name "Valley of the Goblins" aroused our keenest curiosity.



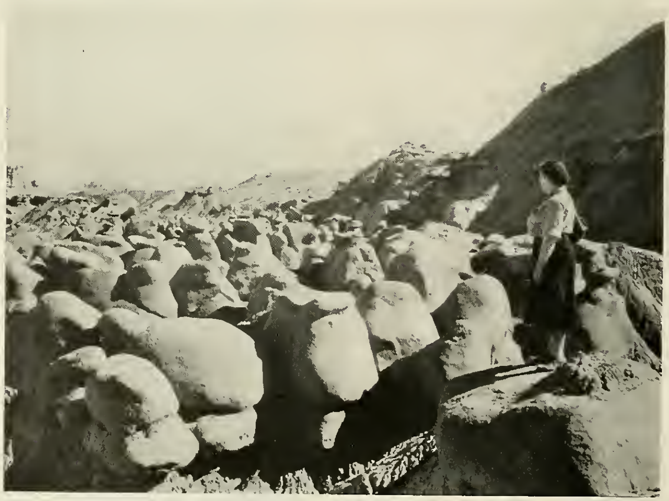
▲ **This reptilian goblin** might be called the King of the Valley. He seems to be looking over the entire "Kingdom" from his high throne

Where was it? And how might we get there? Later we put these questions to several residents, but most of them had never heard of the place. The man who had first mentioned the valley thought he could put us in touch with a neighbor who had been there many years before. Unfortunately, the neighbor was not at home, and we had all but abandoned the idea of visiting the valley when we fell into conversation with the couple at whose home we were to spend the night. Our host said it was his understanding that if we drove across the desert we might see, if the atmosphere was not too hazy, a great rock formation like a mesa rising high above flat country and situated many miles north of the road that runs between Hanksville and Green River. This great promontory, he said, is known locally as Wild Horse Butte. It was his opinion that we might find a dirt road leading to the base of the butte, at which point, if we turned left, we would come to the Valley of the Goblins.

Although this information was vague and we felt our chances of getting to the valley were meager, we set out the next morning in search of the strange goblins. Driving slowly eastward, we looked intently at every marking in the sand toward the north that could be interpreted as wheel tracks. After many false leads, we came to a large post, where the shallow, curving creases in the sand resembled wheel tracks more closely than the many irregularities we had already examined. After considerable deliberation, we decided to break with civilization, and we turned north out across the desert.

The surface seemed firm, and our tires did not sink as deeply into the sand as we had expected. Fortunately it was a clear, bright day with little haze. It was with real misgivings that we watched the road we had left disappear, and we wondered whether or not we would be able to retrace our course. Our apprehensions were not soothed by

▼ **Looking** down over the valley, one forgets the trials of the journey and stands fascinated by the weird sight



the sight of a rusty automobile body half buried in the sand. Some hours later we came upon the bleached and weathered skull of a hapless steer, who, perhaps like ourselves, had wandered too far from the beaten path.

These somber thoughts were abruptly ended by one of the most welcome spectacles that ever greeted our eyes. Looming high on the sky line, just as our host had predicted, was an immense rock formation: Wild Horse Butte! We wanted very much to go directly toward the butte but decided to continue on the firm ground we had been following. It was a wise decision, for our path eventually carried us into rugged country, seamed with steep ridges and broken with broad, deep crevasses. Repeatedly we had welcome reassurance that we were on the right path, for we encountered stretches of road that unmistakably had been cut in the side of steep banks.

The going was difficult and slow. The day grew hot, and the desert seemed to extend interminably in all directions. Any accurate estimation of distance was impossible, but we did know that Wild Horse Butte was growing larger and that details in its precipitous sides were becoming more distinct. Soon we realized that most of our difficulties were behind and that the distance to the

➤ **The Turbaned Highwayman** hides his identity behind a kerchief over mouth and chin

➤ **This goblin** is complete with beak, ruff, and alert eyes base of the butte was almost uninterrupted, undulating desert.

It was three o'clock in the afternoon when we arrived at the butte. I experienced a feeling of almost indescribable joy and of unreality, combined with a strange lapse of memory for the tortuous course over which we had come. Tired, but extremely happy, we rested a little at the base of the butte. Then, fortified with a light lunch and a drink of precious water, we set out on foot toward the Valley of the Goblins.

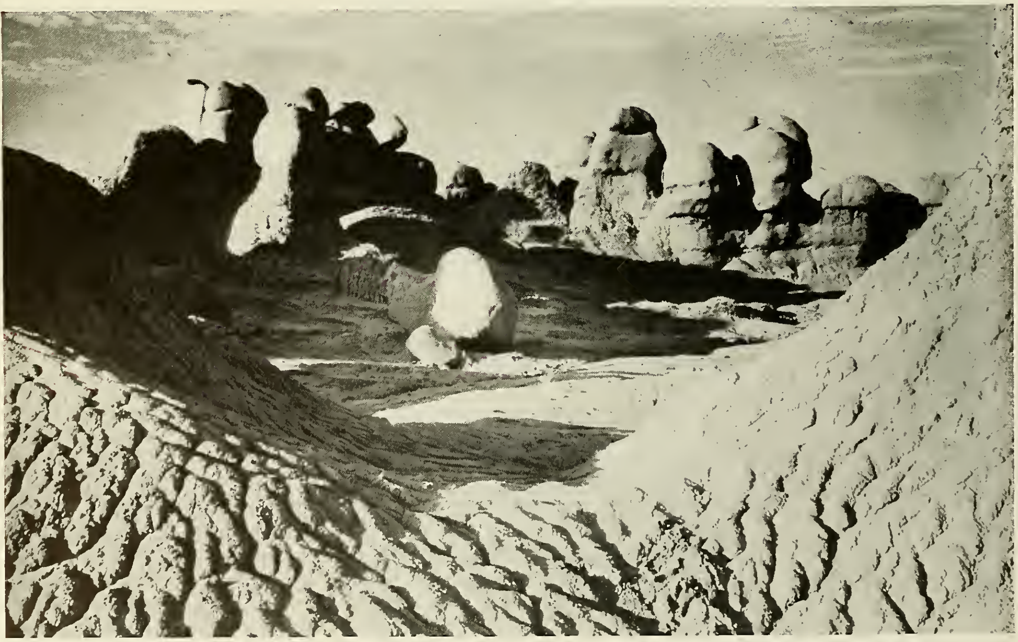
The sand was soft and deep, and I sank into it almost to my ankles. My haste to press forward caused me to slip backward at every stride. Soon, almost breathless, I was compelled to slow my gait to a more deliberate pace. Before long we came upon an area that was steadily rising and deeply gashed with many small, winding canyons. To get beyond these canyons, we were obliged to change our course frequently. As a result of our complete unfamiliarity with the terrain, we often found ourselves at an overlook surrounded on three sides with steep banks that descended abruptly to the narrow canyon bottoms. Determined to maintain a general course directly forward in spite of the canyons, we occasionally walked or slid down the sides and continued along the bottom as one might follow the dry bed of a winding stream. But again, we frequently faced a dead end and were obliged to retrace our steps.

Despite the fatigue and frustrations of the journey, the trip was not without its pleasurable side. Here and there we came upon stretches of open, flat land on which rocks were scattered in great profusion and in a magnificent variety of shapes and colors. We were also impressed with the delicacy of patterning on the sides of most of the canyons. Countless heavy rains must have run down over these banks in a million little rivulets, converging, dividing, and converging again, as the water plunged toward the bottom. After it dried, the soft earth of the canyon walls was left with a lacy, interwoven design, broken only by our footsteps as we struggled to climb to the top of some ridge.

It was nearly five o'clock, and I had begun to wonder if we had correctly understood our host's directions. Were we, after all, going toward the valley? Most of the canyons were behind us, and in front rose the steepest upward ascent we had encountered. This slope was not too rough, and soon we found ourselves on the summit of a high plateau. To the north we could still see our landmark, Wild Horse Butte, while to the south—I could scarcely believe my eyes—lay the reward for all our wanderings: a vast assemblage of Goblins in their Valley!

In the pale orange glow of a low sun there appeared in the foreground row upon row of short, plump goblins, many of them with twisted forelocks, upturned heads, and the amusing countenances of kewpie dolls. Farther back, the goblins were taller. Most of these appeared to be bareheaded; a few seemed to be wearing broad, flat

▼ Reception Committee. It is easy to imagine that this group of stalwart goblins will admit only those with proper credentials



▲ "**Donald Duck**," on a high dry ledge, is out of place, because waterless desert extends on all sides of him

▲ A goblin that resembles a chick sporting a large floppy beret

hats, which cast long shadows across the upper part of their foreheads; while others, with arms extended, were gesticulating to friends on the other side of the valley. In the distance, one side of the valley rose steeply to a jagged sky line. On this incline, as in an amphitheater, tiny goblins with round cherubic heads seemed to be giggling with amusement at the antics of their brothers, who were cavorting in the lower part of the valley. At first I felt we should pause and go no farther lest we interrupt the merrymaking of this festive occasion. But the sun was sinking lower, and it was most urgent that I get some pictures before darkness. We went down into the valley with camera and tripod, and I made portraits of several typical goblins before the light faded completely.

Footsore and weary, we retraced our course to the base of the butte, where we camped for the night. The early morning light of the next day, with different shadows and new angles, directed my attention to many of the goblins I had not noticed the afternoon before. By noon we were on our way back to Wild Horse Butte, thrilled by the richness of our reward and eager, upon returning to civilization, to share with others what we had seen in the Valley of the Goblins.

° ° °

The valley is the result of the erosion of Navajo sandstone by water, wind, and frost. This sandstone is a mixture of soft, porous material in which are embedded in irregular strata harder portions that have been shaped into circular and elliptical forms. Because the softer material has been eroded rather rapidly, the harder, rounded forms remain on the tops of irregular columns which, to the visitor, take on the appearance of goblins. The goblin-like appearance of these grotesque forms is made still more convincing by the variety of interesting shadows that are cast in oblique light. The upper levels of Navajo sandstone are light, almost white, in color. Some of this whitish material appears at the upper rim of the valley, where it is rapidly being eroded into a vast array of fantastic shapes that resemble thrones, cathedrals, and spires. In the lower levels of the valley, where most of the goblins are to be found, the sandstone is red, orange, and yellow in color.

As the observer looks out over the Valley of the Goblins he is impressed by the endless variety of shapes. No two are alike. And as he changes the direction from which he views the valley, these shapes also appear to change. It is difficult, as mentioned before, to estimate distances accurately in this desert country, but I believe that the Valley of the Goblins is about two miles wide and four to five miles long.

The softness of the material and the ease with which the visitor can approach the goblins, once he has entered the valley, present the possibility that unthinking mischief-makers may deface or even destroy these remarkable forms. In order to preserve this area intact and free from commercialization, it would be most desirable that the Valley of the Goblins be designated a National Monument. Thus protected, the valley could in time be made accessible by roads and trails to the general public, who could then share the pleasures and thrills now enjoyed only by the hardy and venturesome.

Is the Guadalupe Fur Sea

Donald Rochlen photo

◄ DR. GEORGE BARTHOLOMEW with a sea lio pup. It was while studying sea lions and elephant seals that he discovered the Guadalup Fur Seal — the only authenticated survivo found in U. S. waters in this century

ONE day last summer, Dr. George Bartholomew, Assistant Professor of Zoology at the University of California at Los Angeles, was tramping along the southern tip of San Nicolas Island, the outermost of the Channel Islands off Southern California. He had been flown by the U. S. Navy to this sandy, barren spot—90 miles due west of the Los Angeles harbor—to take a census of the sea lion population and study elephant seals.

San Nicolas, about eight miles long and two to three miles wide, is a lonely place. The Navy maintains an airstrip there, but the island is dominated by howling winds, flying spray, and the cries of sea birds.

Suddenly—"Gr-r-r-r-r-r!"

From a sandstone shelf, cut up by tidal channels and potholes, Dr. Bartholomew heard a deep, roaring growl. Startled, he turned and saw a huge animal rising from a rocky depression. It was about 5½ feet long, weighed an estimated 300 pounds, and had a pointed, foxlike muzzle and thick neck. Long guard hairs stuck out from its completely dry coat, creating a soft, furry outline. The underfur was brown, and the guard hairs were tipped with yellowish gray—giving the animal a grizzled, almost silvery appearance.

This was neither a sea lion nor an elephant seal, Dr. Bartholomew mused. What was it?

The animal made no precipitous dash toward the water as the sheeplike sea lions do when human beings approach. This old boy held his ground and growled steadily as the zoologist trained his binoculars on him. After about three minutes, the animal backed slowly into a small

eturning?

Considered extinct in recent years, this valuable relative of the Alaskan Fur Seal may be re-establishing itself on the islands off California

By

ANDREW HAMILTON

< IS THIS GRIZZLED OLD WARRIOR the "last man" of the great herds that once lived in these waters?

George Bartholomew photo

tidal channel and swam leisurely and silently away.

The thought hit Dr. Bartholomew like a thunderclap:

This was a Guadalupe Fur Seal—an animal once slaughtered in great numbers along the California and Mexican coast for its rich fur but in recent years considered as extinct as the dodo or the passenger pigeon.

The Guadalupe Fur Seal (*Arctocephalus townsendi*) is a cousin of the Alaskan Fur Seal (*Callorhinus alascanus*). When active on the West Coast, it lived and bred along a 1500-mile string of islands from the Farallones near San Francisco to Socorro Island below Baja California.

After the Danish-born Russian explorer Vitus Bering opened up the Pacific to whaling and sealing in 1741, men of many nations flocked to these waters to hunt seals, sea otters, and fur seals. The latter were prized for the prices they brought in world markets. The rich, heavy pelts of the fur seal made luxurious robes for Chinese mandarins. They were worn by fashionable ladies in St. Petersburg, London, and Paris, and they sold profitably in New York and Boston.

Scientific records on the Guadalupe fur seal's life history are sketchy. But if we can gauge its habits by present knowledge of its Alaskan relative, this is probably how the animal lived and bred: The fur seals were polygamous, and the old males, who probably weighed up to about 500 pounds, "hauled up" first at the breeding beaches. The bulls held certain areas on the beach, and as the females—only about one-fifth their weight—came ashore, they were appropriated by the nearest males. A single harem contained from 15 to 100 females, with 30 the average.

The young were born on shore. With uncanny skill, the females were able to find their "pups" among the thousands of dark, furry youngsters that romped and played on the beach. From the age of one to four, the fur seals were especially playful. They frolicked like a herd of porpoises. Their chief natural enemy was probably the killer whale, which followed them to the breeding beaches and haunted the rookeries.

But it was man, with his mania for profit, who reduced the great herds to virtual extinction. Hunters worked from "mother ships" in canoes and netted the animals by the hundreds. Even more effective, they located the rookeries and went ashore with clubs and beat the animals to death. This slaughter not only eliminated the males and pups but also the females, which were pregnant and would bear the following year.

From written records that have come down in the past 200 years, we know that it was chiefly the Russians and their Aleut hunters who wiped out the Guadalupe fur seal. They skimmed the cream before the American hunters even knew that this animal existed off the California and Mexican coast.

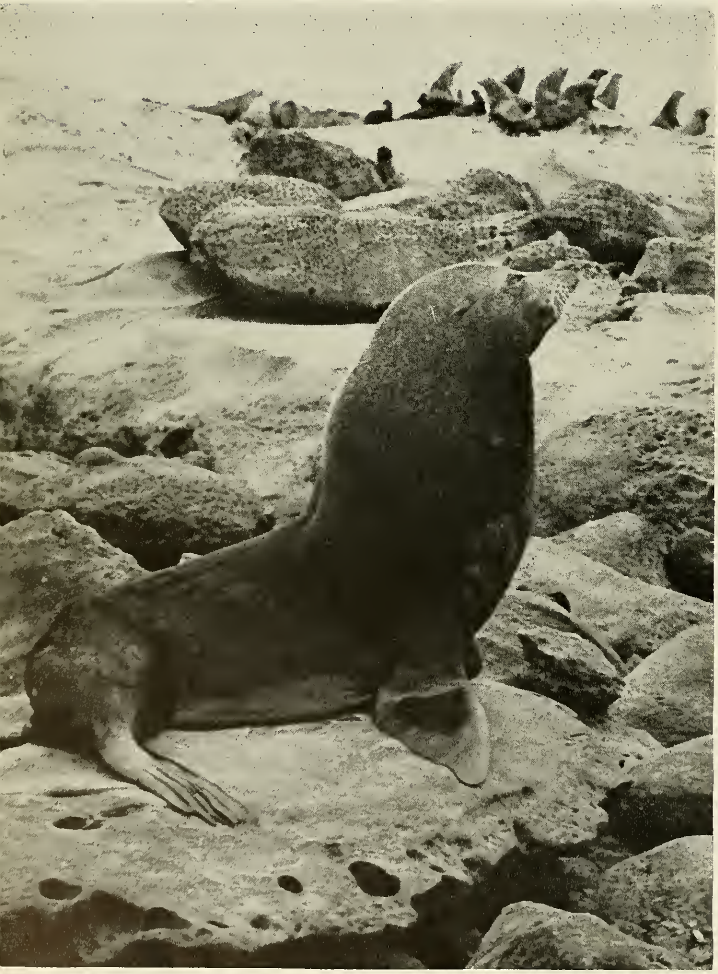
George Bancroft, the great California historian, wrote that "from 1812 to 1840 the Russians kept up an establishment on the Farallones [off San Francisco Bay] as well as at Fort Ross [about 50 miles to the north]. The object was to secure fur seals, 1200 to 1500 skins being taken annually." W. Robinson, who wrote *Life in California* in 1846, put the figure even higher. He says that in some years the Russians took as many as 80,000 skins.

The log of the "Port Au Prince," a whaler that sailed from England in 1805, reported that 8338 fur seals were killed in a period of 19 days around islands off Baja California. The log of the ship "Dromio," out of Boston, shows that the crew arrived at Socorro Island in 1808 and took 3000 seals in two weeks.

The slaughter must have been terrific, for as the nineteenth century neared its end, the Guadalupe fur seals became extremely scarce. Dr. Charles Townsend and A. W. Anthony visited Guadalupe Island in 1892 and found that the herds that once existed there had nearly vanished. They located the great polished rocks at the west side of the island which, at one time, were said to have accommodated 30,000 fur seals. They found the stone huts that served as shelter for the Russians and as storehouses for the hides.

But even then, 59 years ago, the fur seals that took their name from the island of Guadalupe seem to have been doomed. The only evidence that they had once existed in this area were seven animals seen swimming in the water and four broken skulls found on shore. The latter served to identify a new species, *Arctocephalus townsendi,* which had not previously been scientifically classified.

In 1928, however, a San Diego fisherman by the name of William E. Clover captured two Guadalupe fur seal males and reported about "60 animals, bulls, cows and pups" on Guadalupe Island. Several scientific expeditions were sent out to try to capture additional specimens, but the herd was never found. Clover's two males were placed in the San Diego Zoo, where they lived for about a year.



▾ **The Guadalupe Fur Seal** is distinguished by its brown coat with yellowish-gray guard hairs, its pointed foxlike snout, and its massive neck

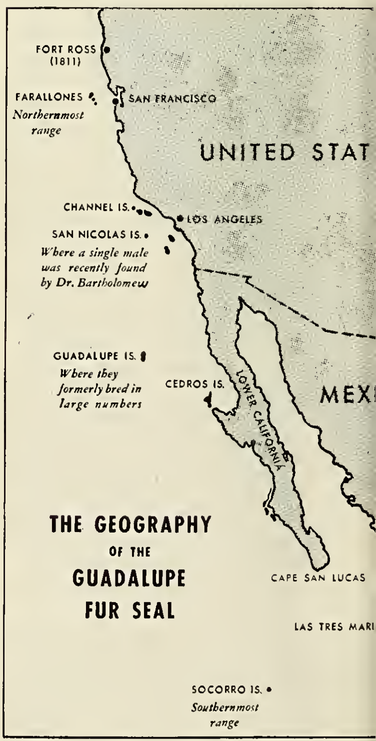
George Bartholomew photo

It is little wonder, therefore, that Dr. Bartholomew was astonished when he saw the big male on San Nicolas Island. When he returned to the University of California at Los Angeles, his colleagues listened with respect, but he could discern overtones of disbelief in the way they questioned him.

"Next time I see a Guadalupe, I'll bring him back alive—on a roll of film," he vowed.

Within a month, Dr. Bartholomew was back on San Nicolas, this time with a companion, William G. Reeder. The first day, they spent seven hours searching the rugged terrain without finding a sign of their quarry.

At 4:30 in the afternoon, when they'd just about decided to call it quits, they spotted the animal asleep at the base of a 10-foot terrace, about 125 feet from the water. The fur seal had adopted a posture often used by sleeping sea lions. It lay flat on its belly with its neck stuck out, its rear flippers pointed back-


FORT ROSS
(1811)
FARALLONES
Northernmost range
SAN FRANCISCO
UNITED STAT
CHANNEL IS.
LOS ANGELES
SAN NICOLAS IS.
Where a single male was recently found by Dr. Bartholomew
GUADALUPE IS.
Where they formerly bred in large numbers
CEDROS IS.
LOWER CALIFORNIA
MEXI
CAPE SAN LUCAS
LAS TRES MARI
SOCORRO IS.
Southernmost range

THE GEOGRAPHY OF THE GUADALUPE FUR SEAL

Donald Rochlen photo

▲ **William G. Reeder** holds a stop watch and Dr. George Bartholomew holds a stethoscope while both wish someone would hold the elephant seal long enough for them to count its heartbeats. The rate proved to be about one per minute

ward, and its front flippers pressed flat against its side.

"There's the Guadalupe fur seal I saw last month—or his twin brother," Dr. Bartholomew whispered to Reeder.

They crawled to the edge of the terrace. As Dr. Bartholomew focused his camera, the fur seal turned its head and growled. Since the animal showed no signs of fright, the zoologist stood up in full view and took photographs from about 20 feet.

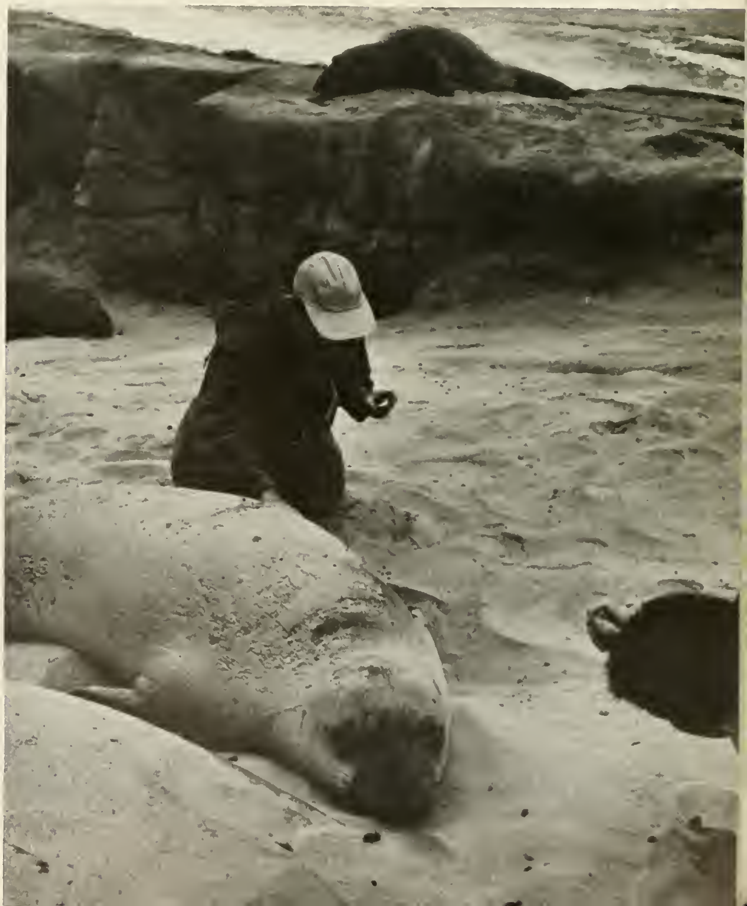
The two men dropped down to the level of the ledge and walked slowly toward the fur seal for a better picture in the fading light. When they were about 15 feet away, the animal charged and chased them for 40 feet. Then it "lolloped" down to the water, swam out to a rock, crawled up on it, and shook itself like a dog.

A month later, when Dr. Bartholomew was completing his sea lion census on San Nicolas, he saw the Guadalupe fur seal a third time—or, to be scientifically correct, he saw either a second or third animal of the same species.

This time Dr. Bartholomew and Reeder were accompanied by Kenneth Stager of the Los Angeles Museum. Again they discovered the animal asleep near the spot where it had been seen the second time. This time it was lying on its back, with rear flippers extended and front flippers crossed over its belly.

Following the shelter of some large rocks, the three men were able to get within twelve feet of the animal. As shutters clicked, it rolled

▼ **Slipping** a thermometer under an elephant seal's flipper, Dr. Bartholomew and William Reeder take the animal's temperature. They found it to be about 95 degrees



over with a growl and faced its two-legged enemies. For 10 minutes the scientists were able to photograph and observe from distances of 30 to 10 feet. Occasionally the beast would charge one of the men, but it did not retreat. Finally tiring of the sport, the fur seal walked slowly and majestically down to the water, stood motionless for a moment, and then plunged in. It was a dramatic exit, for it did not surface within the vision of the three men on shore.

The pattern of vocalization of the Guadalupe fur seal is considerably different from the California Sea Lion, which inhabits the same area. Whereas the latter has a shrill, penetrating bark, the fur seal has a "throaty, muffled sound with sometimes almost the tone of a steamboat whistle." Dr. Bartholomew reports that he has heard three distinct types of sound uttered by the Guadalupe fur seal on San Nicolas Island: (1) a deep roaring sound, made when charging, like the sound uttered by lions and tigers, (2) a deep, hoarse growl, ascending to a querulous rasping tenor note, made when standing still, and (3) occasionally a deep, barking cough.

After observing and photographing the Guadalupe fur seal, Dr. Bartholomew found himself in the dilemma of a whodunit detective who has rounded up all the clues and suspects. All he had to do was to figure out the right answer.

Could the San Nicolas Island fur seal have been an Alaskan Fur Seal that strayed too far south? Decidedly not. Photographs taken by Dr. Bartholomew were compared with those taken of the San Diego Zoo captives before they died in 1929. The nature of the coat, the elongated snout, the low forehead, the slope of the antedorsal skull all proved that this was a genuine Guadalupe fur seal—not a northern carpetbagger.

Was the fur seal on San Nicolas Island a stray from an undiscovered herd that still existed on Guadalupe Island, 400 miles south? This seemed like a good lead, and Dr. Bartholomew investigated it thoroughly. Aboard the "Orca," research vessel for the Joseph W. Sefton Foundation, he and Dr. Carl Hubbs of the Scripps Institution of Oceanography spent two weeks at Guadalupe Island. They found not one single sign or shred of evidence that a herd of fur seals existed there in recent years.

Eliminating the two previous possibilities, was the single Guadalupe fur seal that was seen on San Nicolas Island the "last man" of the great herds that once swam so proudly in these waters off the California coast? Dr. Bartholomew doesn't think so. He believes that somewhere in the rocky fastnesses and lonely coves of Southern California's Channel Islands there may still be a small breeding colony, with virile males and compatible females, to perpetuate the species.

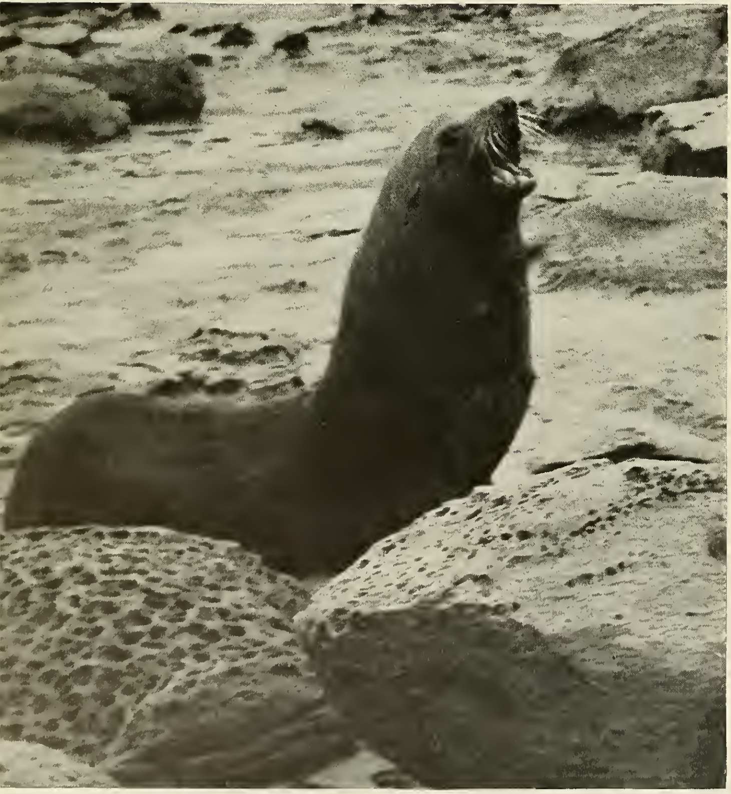
He says: "The coast of San Nicolas is extensively dissected, and there are along it a number of sea caves that are inaccessible from shore. It is entirely possible that there were in the area fur seals other than the one (or two, or three) reported recently.

"The animal (or animals) seen on San Nicolas Island represents the second authenticated record of a living Guadalupe fur seal during the present century, and the first verifiable observation of a living representative of this species in United States waters. It shows that the Guadalupe fur seal is not yet extinct; and it strongly implies that there still exists at some unknown spot a breeding colony of these animals."

The grizzled old warrior that Dr. Bartholomew found on San Nicolas may be evidence that this supposedly extinct animal is actually making a comeback.

▼ **Fur seals** frequent rocky island shores like this, indented with potholes and tidal channels

George Bartholomew photo



SKY ISLANDS OF ARIZONA

Continued from page 63

pecting dogs that happen to be passing by. It is true that a coati will defend itself against an attacking dog—and who can blame it?—but in general they are harmless, interesting animals, which are often tamed as pets in Mexico.

A large band of chulas inhabits the pine forests of the Reef, high up in the Huachuca Mountains. One time I encountered them crossing the Reef Road. I stopped the jeep and waited fully three minutes while scores of coatis—big ones, medium-sized, and troops of babies little larger than kittens—scurried by. Again, at least 50 coatis suddenly dropped from tree branches and slithered down pine trunks all around me. They made off through the woods with a sound in the dead leaves like a heavy downpour of rain. In neither case did the animals appear particularly frightened.

Arizona's sky islands are easy to explore. No long sea voyage is necessary, nor need you go on an extended safari into the wilderness. The higher ranges are within detached sections of Coronado and Crook national forests. Numerous improved automobile campgrounds are maintained by the United States Forest Service, while good foot and horse trails traverse the high country and lead up to lofty ridges commanding sweeping panoramas over thousands of square miles of desert, valleys, hills, and mountains.

In fact, most of the ranges can be visited behind your own steering wheel. The 8000-foot crest of the Pinal Mountains is reached by a good road from Globe, and a 30-mile paved highway climbs from Tucson to the ridge of the Santa Catalinas. Canyon roads penetrate the Santa Rita and Huachuca Mountains, from which trails ascend to the highest summits; and the extensive forest wilderness of the Chiricahuas is breached in several places. The aloof Rincon Mountains alone are still accessible only by pack trail.

Highest and most spectacular road is the Swift Trail, which winds up the gigantic slopes of the Pinaleno Mountains to the broad shoulders of Mount Graham, 10,713 feet above sea level. This well-engineered, graded highway is 36 miles long and takes you 7108 feet skyward through all the climatic and vegetational zones you would encounter on a 2200-mile trip from northern Mexico to Hudson Bay. The changes are so rapid that you have a feeling of riding a rocket northward at 1000 miles an hour.

One day last summer—June 30 to be exact—a companion and I made the incredible jump from sweltering desert to Mount Graham's summit snows in three hours and a half. Starting from Safford, 2930 feet elevation, at 9:15 A.M. in a temperature of 86 degrees F., we were dressed in shorts and light shirts. At the junction of the highway with the Swift Trail, seven miles south, we hung a maximum recording thermometer in the shade of a gnarled old ironwood tree. A sparse growth of yucca, cactus, ocotillo, creosote bush, and other stunted desert shrubs characterize the area as the Lower Sonoran Zone. This is the hottest and driest life zone in western North America, and it is named after the state of Sonora in northern Mexico where such deserts are common. Temperatures here in summer rise to 110 to 115 degrees F., and the average yearly rainfall is but 8 to 10 inches.

Five minutes later the car swung into the first loop on its climb of the kaleidoscopic climate ladder into the sky. The desert soon gave way to grassy hillsides dotted with oaks, which increased with altitude to open woodlands. Here was the next zone, the Upper Sonoran, extending from 4500 to 6500 feet. This has one of the pleasantest year-round climates in the United States, and there are extensive areas of this zone in southeastern Arizona. Summer temperatures seldom go above 100 degrees F., and winter cold is tempered by a warm southern sun. Precipitation ranges from 12 to 20 inches, with the heaviest rains falling in July and August.

Stands of Chihuahua pines and increasingly heavy growth of ponderosa pines announced that we

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had left the Upper Sonoran and set foot on the next rung of the climate ladder, the Transition Zone. The final climb to the ridge was made in a series of switchbacks through a dark green aisle of white firs, Douglas firs, oaks, alders, and maples. Between the trees we caught fleeting glimpses of the shining desert more than a mile below us.

At 10:45 A.M. we parked the car at 9100 feet and took the 4-mile Mount Graham trail on foot. We had reached the Canadian Zone with a climate resembling northern Maine or Minnesota. Here were spiry alpine firs, spruce, and quaking aspen, fern-banked streams and green meadows spread with wildflowers. For this high oasis above the desert has an annual precipitation of 40 inches—equal to that of New York City. The temperature as we started up the trail was a chilly 64 degrees F., and we had donned trousers and jackets.

As we hiked up through the deep evergreen woods past majestic Douglas firs seven feet in diameter, we might have been in Oregon or British Columbia rather than within a few miles of the Mexican border. Friendly chicadees, chattering squirrels, and the sight of a bear lumbering off up the mountainside heightened the effect of being in the North Woods.

The first snow patches were encountered at 11:25 A.M., and from then on we labored over a firm, frozen pack from a foot to seven feet deep. We topped the great dome of Mount Graham at 12:45 P.M., and on went gloves and extra sweaters. A bleak wind whistled through the stunted spruces, and scudding clouds blotted out the sun. Our thermometer read 52 degrees F.

Shaking with cold, we looked back down the climate ladder to the desert shimmering in heat waves 8000 feet below. The high temperature for the day in the shade of our ironwood tree down there was 108 degrees F.—a difference of 56 degrees F. in an airline distance of ten miles! So, while we experienced weather at the summit similar to that of the Alaskan coast, we could survey five of the seven life zones of western North America on the plunging mountain slopes beneath us. Only the two ends of the ladder were missing: its topmost rung, the frigid Arctic-Alpine Zone; and at the bottom, the steaming, humid, Tropical Zone, found along the coasts of southern Mexico.

But the seasons, too, bring amazing changes and variety to these mountains. Whether it be the high-piled, white thunderclouds of summer, deep winter snows in the quiet forests, or the flaming maples and golden aspens of autumn, there are always new wonders and beauties waiting to be discovered on the soaring Sky Islands of Arizona. There is also at all seasons the peace and satisfaction best found in nature's wildest places.

LETTERS

Continued from page 50

in the sources as to the direction. Some state that the immigrants come from the east, others from the west. Heyerdahl emphasizes the importance of this tradition. However, it cannot refer to Peruvians, since the migrants came in two large double canoes typical of the Polynesians and not on Peruvian rafts. It can only refer to Polynesians returning from a trip to America. Such recent east-to-west reflex migrations from Polynesia are well known in eastern Melanesia, as for instance in Fiji, where they can be clearly distinguished from the west-to-east migrations of the early Polynesians.

Also, the facts of physical anthropology contradict an American origin for the Polynesians. Mongoloid features are very strong in the western Pacific and decrease markedly from west to east. Had the Polynesians come from America, one would expect such features to be about as strong in eastern Polynesia as they are in the South American Indians.

When Heyerdahl identifies the Polynesian god Tiki with the Peruvian hero Kon Tiki, the unprepared reader may easily be taken off guard. Kon Tiki's full name is Con-Tici-Wiracocha, Con-Tici being a title. To take part of that title, the word Tici, and equate it with the Polynesian name Tiki is the more arbitrary, since there is not sufficient evidence in the traditions to justify this equation.

Heyerdahl's merit lies not only in his demonstration of the feasibility of a raft voyage across the Pacific, but also in the fact that he has added a few more traits to the long list of already well-known similarities between America, the Pacific, and the Old World. One may even grant him that some of these common elements might have been brought to Polynesia by raft voyages from America. Whereas this enriches our knowledge of the ways of possible trans-Pacific culture contact, it does not, however, shake the well-established belief of most authorities that the Polynesians originated in Asia.

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Inquire P. E. LEWIS,
Oregon Audubon Society, Tigard, Ore.

SIRS: ***A Slow Boat***

I was very much interested in your January issue.

In the first place, I believe the explanation of the Flying Saucers is the best that I have ever seen.

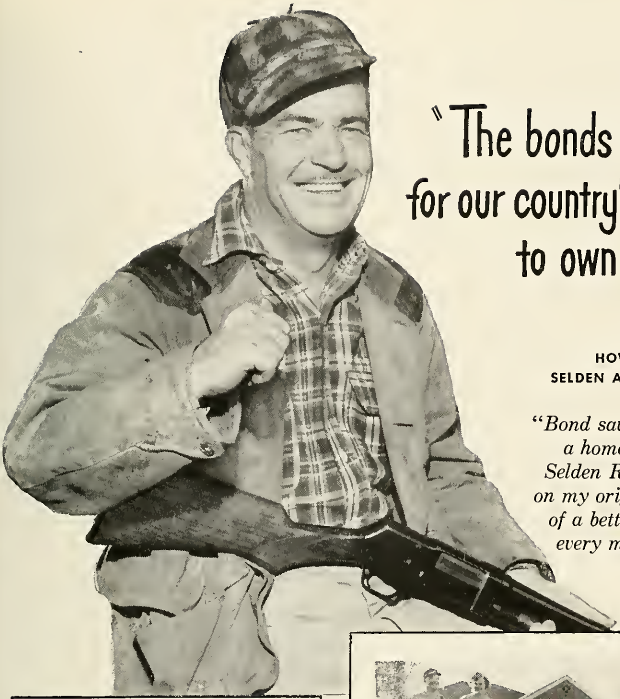
Strangely enough, I have seen these things go by while in an airplane but, of course, always traveling in the opposite direction. I was perfectly aware of what they were, however, and have never seen these strands of silk in the perfect shapes with which your artist has illustrated them.

Also, I was much interested in the Feather Falls in California and am sending the issue on out to a friend of mine in San Francisco.

Mainly, however, I want you to tell Dr. Eugenie Clark that I am deeply in love with her and quite willing to accompany her on any trips she might be making to the South Seas.

(Name withheld)

Dr. Eugenie Clark has already left on another long expedition—to a remote section on the shores of the Red Sea—and has promised NATURAL HISTORY further accounts of her extraordinary travels.—ED.



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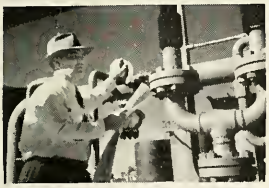

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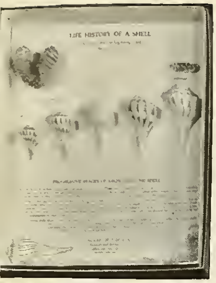
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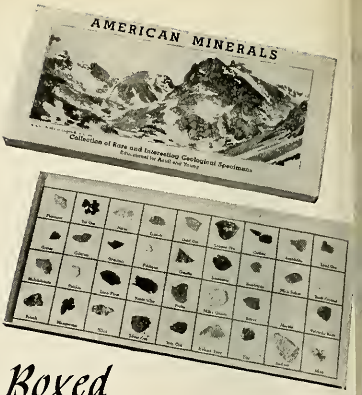
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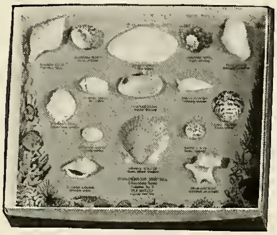

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LETTERS

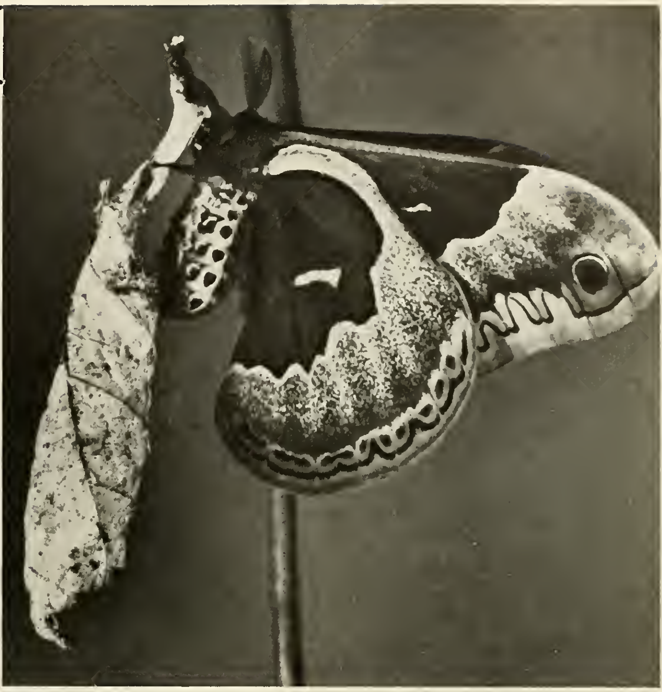
An Uninvited Guest

Sirs:

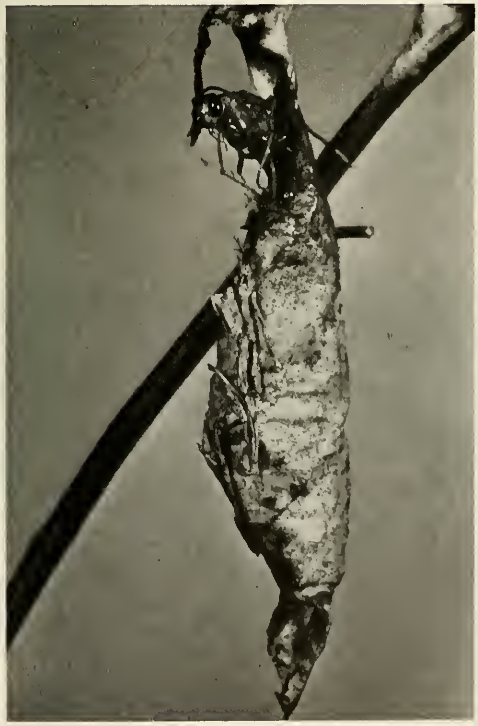
For several seasons I gathered Promethea moth cocoons in the hope of photographing the emergence of the adult moth. As many readers know, the large green caterpillars that transform into the Promethea moth, *Callosamia promethea*, are most commonly found during the summer, feeding on the leaves of wild cherry, sweet gum, lilac, and a few other shrubs. When full grown, they build this cocoon within a rolled leaf that has been firmly attached to the twig by strong silk threads.

For two years I missed every emergence. Then one evening I came into my study and observed a head just sticking out of the cocoon. Thinking to myself, "This is it," I hastily put the twig on the desk and brought my camera and lights into action for a close-up. But as the insect emerged, it became evident that a surprise was in store for me.

It was no Promethea that emerged from my cocoon. There are several kinds of parasites that lay their eggs in the caterpillar of the Promethea and related moths. Among the common parasites are

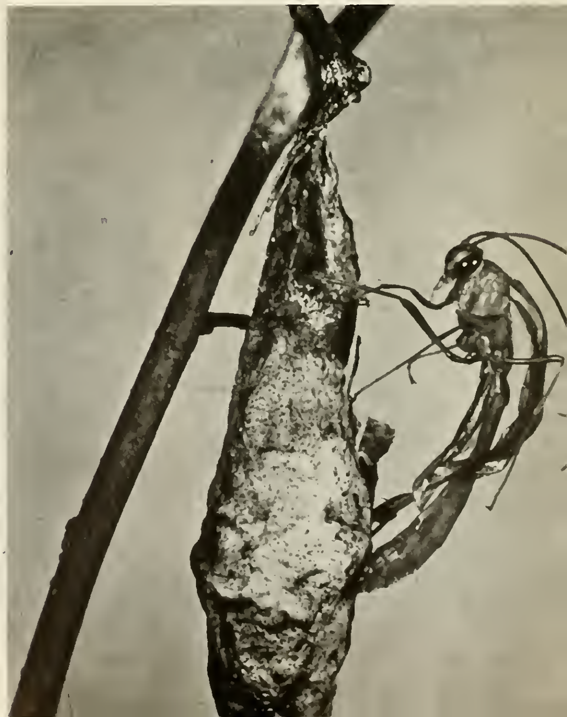


⮝ ORDINARILY, a Promethea moth would have emerged from the cocoon, as shown here



⮜ BUT a curious looking creature stuck its head out

⮟ A parasitic wasp belonging to the large family known as "ichneumon flies" emerged from the Promethea cocoon



species of *Ophion*, parasitic moths belonging to a large family known as ichneumon flies. It is one of these that is shown coming out of my Promethea cocoon. I am told that this may be the first time that this event has been photographed.

J. R. SWAIN

Middletown, Conn.

SIRS:

Thanks for your inspiring publication; it suits our temperament. The excellent printing, splendid illustrations, and fascinating articles in NATURAL HISTORY make fine fare for winter evenings in the hill country.

Most magazines are short-lived in our household, but it looks as if NATURAL HISTORY will remain with us for many years.

The November cover of the Prothonotary Warbler, with the coloring enhanced by the bird's shadow, is an example of arresting beauty.

In a world racing mad against time, NATURAL HISTORY is refreshing in its timelessness . . .

HOWARD T. LAKEY

Newburgh, N. Y.

Stefansson on Snowhouses

SIRS:

In your good remarks on the good photographs of the Right Reverend D. B. Marsh, Bishop of the Arctic for the Anglican Church of Canada, you say in the February NATURAL HISTORY:

". . . Bishop Marsh informs us that these Padlemiut Eskimos live in temperatures sometimes as low as 40 degrees below zero inside the snow hut."

The "temperature sometimes as low as 40 degrees below zero" seems to require interpretation. Having lived in unheated snowhouses at the outdoor temperatures you mention, and having found that the body heat of the occupants normally brings the interior temperatures well above Fahrenheit zero, I have thought (not doubting the Bishop's verbal accuracy) that there would have to be one of five interpretations, namely that he is talking of (1) a house just after it has been built, when the temperature of the snow blocks themselves is the same as that out-of-doors and will rise only slowly, (2) a house that has a white-man type door in the wall instead of in the floor, not allowing for gravity control of the air, (3) a house that is white-man style in the sense of being so large in relation to the number of occupants that it is difficult to heat, (4) that he placed his thermometer too near the floor, or (5) that, like many brought up in England, he speaks in terms of "below freezing" which we readily confuse with "below zero."

The best statement I know of for unheated snowhouses in the general region described by Bishop Marsh is in David T. Hanbury's *Sport and Travel in the Northland of Canada*. The snowhouses Hanbury speaks of may even have been the proportionately large ones he had built for himself. Explaining that he took the temperatures of different iglus all through the winter he says, "For the first day of its occupation, a newly-built iglu remains cold. When the thermometer outside registers any temperature from −20° to −50° Fahr., the temperature inside is only about 10° higher; sometimes not so much. Next day, however, when the iglu has settled somewhat, and more snow has been thrown on the roof, the temperature is brought to about 24° or 26° (i.e., 6° or 8° of frost), and there it remains, the temperature outside having little or no effect on that inside."

From the snowhouse experience of the Boy Scouts at Saranac Lake and of Dartmouth students at Hanover, as well as from my own experience, I know that when a house is built of good snow and occupied by four or more persons, and when it is no larger than required by Eskimo standards, then one built in the evening and slept in will be at least 40 degrees warmer in the morning than the temperature out-of-doors, if the weather is very cold. The temperatures I have in mind would be registered by a Fahrenheit

continued on page 143

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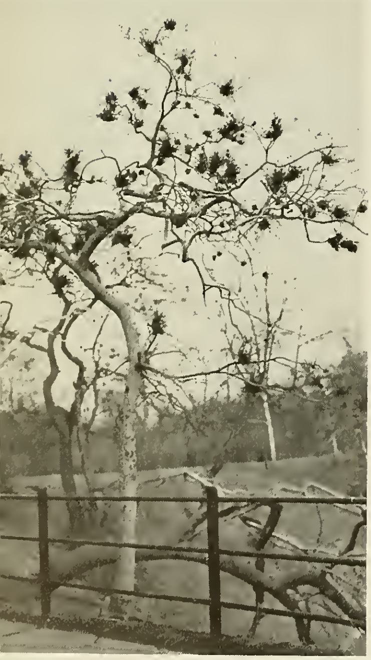
Witches'-brooms

SIRS:

I am wondering whether your readers are acquainted with Witches'-brooms. Fungus or insects are believed to cause these growths, which make their appearance as tufts of twigs on the ends of many of the branches.

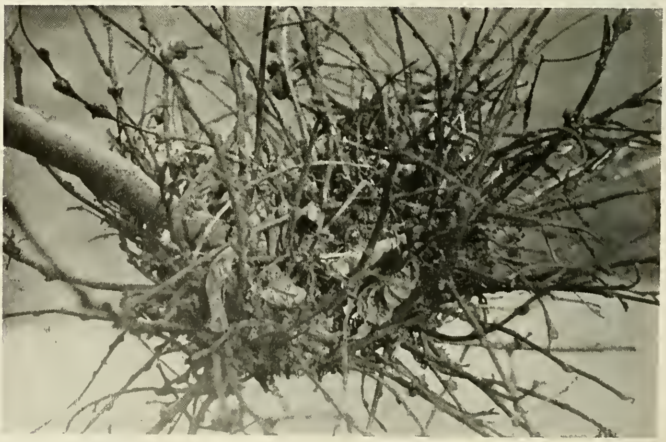
DOROTHY FREAS

Woodhaven, N. Y.



◄ HAVE YOU SEEN THEM . . .

▼ CLOSE UP?



NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—NO. 3
MARCH, 1951

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From a color photograph by Jack Breed

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You will find NATURAL HISTORY *Magazine indexed in* Reader's Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The Indians of our Southwest have long inspired photographers, and one of the most photogenic is Ada-Ki-Yazzi, a medicine man of the Navajo tribe. On this month's cover you see him as he posed for Jack Breed with his favorite white pony. They are near Mitten Butte in Monument Valley on the Utah-Arizona border.

Ada-Ki-Yazzi, whose name means "Little Gambler" in English, is one of the 62,000 Navajos struggling to keep alive in their arid 25,000-square-mile reservation. Sheep and goats are their prime means of livelihood, supplying them with food, clothing, and the wool with which to weave their famous Navajo rugs.

Our Cover Navajo keeps his large family in a group of earth-covered lodges, or hogans, near the base of Train Rock at the northern edge of Monument Valley. When this picture was taken, Ada-Ki-Yazzi had just officiated at a four-day sand-painting ritual in which he served as the Chief Shaman. In marked contrast to this brief religious interlude, he returned the next day to his current job as caretaker on a permanent Hollywood movie set that has been erected in the valley to provide the "local town" in various Westerns!

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DE RE METALLICA

- - - - - - by Georgius Agricola; translated by Herbert C. Hoover and Lou Henry Hoover

Dover Press, $10.00
638 pp., 280 illusts.

IT is a little late, almost 400 years, to write a review of the substance of this work, a book which led its field for nearly 200 years. In some respects, Agricola foreshadowed many modern theories of geology, both as to the erosional origin of mountains and to the subsequent deposition of ore veins in older rocks. The chief interest in the work today is threefold, but no one should expect to learn anything new from it since there are more modern books for the student of modern mining.

The identity of the translators naturally evokes considerable interest; few people today realize that former President Hoover was such a scholar. Probably he has not had the leisure for such a time-consuming job since he entered public life. The first printing of the work was an edition of limited size published in facsimile style in London in 1912. For many years now, this beautifully printed work has been a collector's item, often costing as much as the first Latin edition of 1556.

In recent years several ancient works have been translated and reissued for the benefit of a new generation of students. This reprinting by the Dover Press is very welcome, since it has made another classic, the finest of all mining books, available at a moderate cost.

To many people, the reappearance of this translation—the only one in English—will be of interest because of the new light it gives on Mr. Hoover. The careful reproduction of the 1912 edition, with its clear woodcuts from the original and its imitation of the arrangement of the 1556 edition, gives the modern reader something of the feeling of the old book. It also impresses us again, as do all of these imitation facsimiles, with the bookmaking craft of the early printers, who were prouder of their products than of their productivity.

The appendices and the index added by the translators point out the importance of the work, its place in the history of mining literature and in the advancement of science generally, and, incidentally, the tremendous amount of work and collateral reading exhibited by the Hoovers. All of the work, slightly reduced in size from the original so that it now is a quarto volume, is taken from the 1912 printing, page for page. The woodcuts are just as sharp, the type just as clear. The bibliophile, the student of mining or chemistry, and admirers of Mr. Hoover's many talents should all find this a book well worth adding to their libraries.

F. H. Pough

THE SMITHSONIAN— AMERICA'S TREASURE HOUSE

- - - - by Webster Prentiss True

Sheridan House, $3.50, 306 pp.

THE Smithsonian Institution is quite unlike any other public institution in the world. Made possible in the beginning by a bequest from James Smithson, an Englishman who had never been in the United States, it has grown through government support and donations from individuals into a vast aggregation of ten bureaus which deal with many aspects of natural history and art. This growth has taken place over a span of more than 100 years. The United States National Museum is one of the best known of these bureaus, and it is much the largest.

Mr. True relates in an interesting fashion how this expansion, from the original Smithsonian Building, took place. The will of Smithson specified "an establishment for the increase and diffusion of knowledge among men." This broad base for administration of the legacy was extremely fortunate both in its acceptability to the Government of the United States and as a stimulating philosophy for future growth. The story of the Englishman who made this friendly international gesture, and the steps necessary to implement the bequest, are an entertaining part of the book.

In the early years natural history had many unexplored frontiers. It was an advantage for the Smithsonian to start from scratch, and the wealth of accessions that began to accrue called for expansion to keep abreast of progress. Out of this has grown the great physical plant with its administrative and scientific staff, which justifies the subtitle *America's Treasure House*.

Today the world has shrunk in more ways than one. Highways and cities occupy the unexplored remoteness of a century ago; the ruthlessness of man has wiped many natural features from the face of the earth. But better understanding has opened new lines of research in natural history, and future prospects shift the emphasis from accession to use. The Smithsonian occupies a strong position because it has acquired so much material under the more favorable circumstances of the past and has the trained staff to guard and use it for future generations.

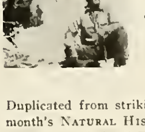
Harold E. Anthony

WILD ANIMALS IN BRITAIN

- - - - - - - - by Oliver G. Pike

Macmillan and Co., London, $3.75
226 pp., 87 illusts.

". . . There is no greater thrill to a nature lover than to feel the tiny soft imprint of a small bird's foot on an outstretched hand, or to see a wild mammal emerge from its lair and fearlessly approach him." So writes Oliver G. Pike in his introductory note to *Wild Animals of Britain*. That there is still an abundance of England's native creatures, as shown by the author of this book, is a remark-



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able example of the tenacity of wildlife under adverse conditions. From the pages of this book the reader readily perceives that Mr. Pike has lived with the wild creatures of Britain since his childhood days and loved his friends in the woods, fields, and streams. He tells about these animals and his experiences in a manner that takes me back to my boyhood days in England when I captured alive a large venomous adder and kept it in the house a month before my parents learned the awful truth.

Mr. Pike does not limit himself to descriptions of the mammals, reptiles, and amphibians. Wherever possible he adds his own personal experiences with them.

There is a short chapter on the study of animals in general, where the author tells how to make friends with the wild creatures that have been hunted and persecuted by man from time immemorial.

By far the greater part of this book is devoted to the study of mammals, but there is a chapter on reptiles, introducing the snakes and lizards, and one on the amphibians—frogs, toads, and newts.

Wild Animals of Britain is illustrated with seven attractive color plates. The frontispiece is a red fox in full color with the appropriate caption "Dawn Patrol." Numerous interesting photographs of animals in action, taken by the author, add greatly to the instructive value of the book. While the title does class this book as somewhat regional, any nature lover will unquestionably find it well worth reading.

Mr. Oliver Pike is a well-known animal photographer and student of animal life. He is a Fellow of the Zoological Society of London, Hon. Fellow of the Royal Photographic Society and of the Institute of British Photographers, and a member of the British Ornithologist Union.

George G. Goodwin

BOTANY

- - - - - - - by R. Darnley Gibbs

The Blakiston Co., $6.00
554 pp., 261 figs., 118 plates

THIS is a textbook of botany designed for the introductory course at the college level. It is an all-inclusive type of text, fully ample for a year's work in this science. Unfortunately, most educational institutions can spare no more than a half year to introductory botany.

Unlike most currently used college textbooks in elementary botany, which introduce the student first to the morphology and physiology of a familiar higher plant, Professor Gibbs (of McGill University) has gone back to what he feels is a more logical "evolutionary approach." Thus he starts with the lowly algae, follows with the fungi, passes through the intermediate groups, and finishes up with a standard presentation of the vascular plants with emphasis on the anatomy and physiology of the angiosperms. Special chapters have also been included introducing the student to taxonomy, economic botany, "dependent and carnivorous plants," soil, phytogeography, and evolution and genetics. A brief bibliography is appended as well as "suggestions for further study," the latter to be found as a good concluding feature to each chapter. This text is well illustrated by both photographs and drawings. Many of these offer new subject material. In general, the drawings appear to be superior to the photographs, certain of which might have been better taken.

W. H. Hodge

FISH, FOWL AND FOREIGN LANDS

- - - - - - - - by J. D. Greenway

Charles Scribner's Sons, $3.50
176 pp. 23 illusts.

THE jacket blurb says, "We must leave it to the reader to argue whether this is primarily: 1) An intensely amusing book about the oddities of diplomatic life . . . 2) An unusually delightful book about fishing in most corners of the globe by a fisherman with a very endearing personality." The author says the book is "the story of the belated conversion and slow education of a passionate fisherman."

Mr. Greenway's diplomatic career has led him to Rome, Prague, London, Moscow, Bucharest, Sweden, China, Persia, and Panama, with side trips to almost everywhere. In Prague he learned to fly cast, the result a "small and solitary trout weighing about a quarter of a pound . . . foulhooked and dragged ashore by brute force." This episode, by a Wodehousian logic, seems to have landed him in Woolwich to encounter life under a regimental sergeant. Big game anglers first met him as British Minister to Panama, and at the moment he is en route to a new post in Iceland.

The book is a choice combination of sense and nonsense, emanating from a quick, flexible, and extremely fine mind, which, just in passing, acquired the following languages: Rumanian, Greek, Persian, Portuguese, Chinese, and Russian. Added to this is an obviously classical education, omnivorous reading, and a spirit of adventure. There are vivid and delightful descriptions of the sights and smells of Chungking, the beauty of the descent from the Mazanderan Mountains to the Caspian Sea, fishing in the Em, the Laerdal, the Esk, and the Tweed; learning the Spey cast; five days on the Grimersta in the Outer Hebrides; big game fishing in the Galápagos, for Sailfish in Panama and for Bonefish and Tuna in the Bahamas, as well as superb wildfowl shooting near Bucharest and in the marshes outside Cairo.

As a woman, I would add that women, and also men who insist on taking them along, would do well to read the author's pungent remarks on the joy of being free to fish "untrammeled and unharassed by the female sex." I wonder who took the photograph entitled "Woman Fishing"!

Francesca LaMonte

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THE STRANGE WORLD OF NATURE

- - - - - - - - by Bernard Gooch

Lutterworth Press, London, 10/6
160 pp., 29 wood engravings

THE wide scope spanned by this slender book may be seen from its contents: The first part deals with the animals themselves, the second with their approach to life, discussing eating and being eaten, protection from moisture, rearing the young, and the use of tools. The third part is devoted to problems of interpretation. This book is filled with a learned British naturalist's keen and affectionate observations on animals, ranging from sea anemones to rodents, and enhanced by Joan Hassall's wood engravings which live up to the author's level.

Although Mr. Gooch cannot conceal his deep love for all living creatures, he never permits it to degenerate into false sentimentality. He keeps equally aloof from any unwarranted anthropomorphism and emphatically cautions the reader against such interpretations of animal behavior, as long as better ones can be thought of. He propounds rational interpretation or else admits that we do not know the answer.

Combined with painstaking observation and recording, there is heart-warming humor throughout the book. Of the many anecdotes, this reviewer liked best the description of the crowded life of the guillemots on their narrow cliff ledges, resulting in the loss of many eggs every year and, eventually, in the feeding of a stolen fish to a stolen chick by adoptive parents.

Most of the author's examples, it is true, are taken from England's seashore and countryside, but this does not in any way reduce the value of the book to naturalists in other parts of the world. This book can be recommended most warmly to every nature lover. I, for one, enjoyed every page of it.

Otto Haas

INDIANS OF PERU

- - - - - Photos by Pierre Verger;
Text by Luis E. Valcarcel

Pantheon Books, $7.50
5 pp. of text; 87 pp. of photos

THIS attractive book is an album of photographs by an internationally-known French photographer and is prefaced by a pleasant, but exceeding brief, introductory text in English and Spanish by the Director of the National Museum of History in Lima. The title is somewhat misleading since the photographs actually cover a wide variety of subjects, including Inca fortresses, Spanish Colonial architecture, fiestas, and landscapes, in addition to Peruvian Indians. Each picture is excellent, and several are of exceptional quality.

The plates are organized into five groups illustrating all major geographical regions of Peru: the desert coast, the northern, central, and southern highlands, and the jungles of the east Andean slopes. Except for this general geographical grouping, the photographs have no larger unity and tell no consecutive, coherent story. Rather they are, as Dr. Valcarcel writes, "windows giving on Peru." While the book will be appreciated by anyone who enjoys outstanding photography, it will unquestionably mean more to the reader who has some firsthand knowledge of Latin America.

Harry Tschopik, Jr.

RUXTON OF THE ROCKIES

- by Clyde and Mae Reed Porter
Edited by LeRoy R. Hafen

University of Oklahoma Press, $5.00
325 pp., 16 illusts.

THIS is largely autobiographical, but there are gaps in Ruxton's diaries and these are bridged over by data derived from several sources.

George Frederick Ruxton, an adventurous Englishman, lived from 1821 to 1848, and in that brief span of time tried his hand at soldiering, exploring, and hunting. His travels took him to Spain, to Africa, and to North America. He had a flair for adventure which is apparent from his choice of activities and also from the tenor of his writings. His military career was short, and most of the book is devoted to his activity as an explorer. As a traveler he was most interested in the hunting he could do, although he also made observations on the native peoples he encountered. He wrote two books, *Adventures in Mexico and the Rocky Mountains* and *Life in the Far West.* These are valuable as firsthand impressions of an environment and culture now vanished. His writings and his enthusiasm created a favorable impression in England, and he would doubtless have received support for further exploration had his career not come to such an untimely end.

Ruxton was self-reliant and did not lack for courage. On numerous occasions he took risks which might well have proved fatal if chance had turned against him. A cynic might conclude that these early drafts against the credit side of chance found him overdrawn when illness struck him. It is sufficient to note that the adventures he crowded into his few years would have been more than ample for the normal lifetime of the average individual.

This book will serve to direct attention to travels in North America that have probably not come within the knowledge of the average reader. It is in this field that Ruxton has made his greatest contribution. The incidents of his earlier life lack this unique character.

Harold E. Anthony

THE INCOMPARABLE VALLEY

A Geological Interpretation of the Yosemite
- - - - - - by François E. Matthes

University of California Press, $3.75
160 pp., 63 illusts.

"THE fullest appreciation of any landscape comes only when one is alive to its meaning also. Surely in the sublime Yosemite region this truth should provide an absorbing, even exciting intellectual adventure. We seek an answer to the question: By what circumstances did the Yosemite become endowed with scenic grandeur so exceptional that men have termed it 'the Incomparable Valley'?

"To answer this question has been the author's pursuit through years that have lengthened into decades; and to share with others the answers he has found has been his greatest happiness."

So wrote Dr. François E. Matthes, world authority on the geology of the area he writes about, a man whose technical reports on the region are classics in their field. Possessed, however, of a feeling of obligation to present his knowledge in terms that all who wished might appreciate the wonders of the area, Matthes, following his retirement from service as a government geologist in 1947, set as his goal the preparation of the present nontechnical account of the history of the Yosemite. This goal was not achieved; Matthes died in June, 1948. The work was brought to completion by Dr. Fritiof Fryxell, who had spent much of ten years with Matthes in the Yosemite and in the Washington offices of the Geological Survey.

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By the Author of
The Lungfish, the Dodo, and the Unicorn

THE VIKING PRESS
18 East 48th St., New York 17, N. Y.

We have, then, in this book, an authoritative account of the Yosemite Valley, as its story has been read by the geologist. Its development is traced from the time that it was the valley of a small mountain stream in the young Sierras down to the present day, with special emphasis on the three successive periods of glaciation, when advancing ice sheets carved the features that make the distinctive scenery of today. The importance of the geology of the region as the determining factor in the effect of the glacial erosion is given major emphasis throughout.

The beautiful photographs by Ansel Adams are supplemented by others of equal charm, many by Dr. Matthes himself. The one illustration that is lacking is an adequate map of the valley, upon which the reader might be permitted to orient himself as he reads the descriptions of the many parts of the area. Dr. Matthes' detailed map published in his monumental report on the valley will not be readily accessible to most; it or one like it included here would add much to an already valuable work.

H. E. Vokes

IN SEARCH OF TH

OUR Chinese junk, the "Cheng-Ho," must have presented an odd sight to the Fijian natives on shore as the morning sun glanced off the gold, blue, and red-lacquered paintings on the ship's sides. For two hours we had paralleled the eastern shore of Vanua Levu Island, and at last our junk had turned out of the wind to enter the narrow channel in front of Tunoloa village. As the junk wallowed on the heavy swells of the dark blue cut in the reef, the great bamboo sails lowered slowly like folding fans. Abreast of us the large waves were swelling in from the open ocean and breaking in confusion over the long, offshore reefs. Ahead of us, in front of the Fijian village, a green-watered lagoon, placid and hot, offered a peaceful anchorage. And beyond the white, sandy beach, dotted with outrigger canoes, the village peeked out from a heavy growth of breadfruit trees.

By the time the anchor had let slip and its chain had snaked noisily overboard in a puff of rust dust, a large group of excited natives had gathered on the beach. This was the sixth landfall for the Harvard-Archbold Expedition to Melanesia in 1941, and in the past six weeks we had accustomed ourselves to the intricacies of landing among peoples whose inquisitiveness was exceeded only by our own scientific curiosity. Dr. Wesley Coulter, leader of the expedition, had learned to make his contacts early with the native chiefs or local British officials, so that his investigations on the agricultural conditions and geography of the area could proceed as quickly as possible. Mrs. Anne Archbold, owner of the modern junk-yacht, "Cheng-Ho," and our photographer, John Swingle, would generally land first and would Pied-Piper through the settlement and out into the country. This permitted a leisurely landing later for Dr. Otto Degener, our plant-collecting botanist, and for myself.

My main task was to amass a study collection of the land and marine mollusks of Fiji for Harvard University. Despite the many biological investigations awaiting the seashell fauna of this area, I could not help but turn much of my searches toward the rare and beautiful golden cowrie (*Cypraea aurantium*). At first, I had held a secret and greedy desire to return home with several dozen specimens, but as weeks slipped into months, I realized that its reported rarity was no myth. By now, I would have been satisfied with even a single example.

I went below to my cabin to finish work on rebottling and relabeling, an arduous and ever-present task which had been neglected while we were pitching and rolling on the high seas. The first launch went ashore immediately with Mrs. Archbold and company, and it was nearly an hour before I took my turn to the beach. I found the small village deserted and pleasantly quiet. I was rather surprised to find Tunoloa so neat and clean. Its attractiveness was due in part to the quaint European church and the two coral-stone mission houses that dominated the grounds. Around the high-walled church were clustered a dozen squat, grass huts, whose tiny gardens were shaded by large, spreading breadfruit trees. The unusual absence of rotting fruit on the ground accounted for the equally unusual absence of droves of flies. The central village yard and nearby paths leading out of the village were packed with clean, white coral gravel.

I stood for awhile deciding which trail to follow, then turned and headed north toward the collecting reef I had seen from the junk. At the north end of Tunoloa beach, where the sand gives way to a rather rocky stretch, a large, flat coral shelf juts out into the sea. At low tide a half mile square of coral rock is exposed. At this moment, the tide was just reaching the low mark, and the reef populace was just beginning to shut down for the hot, sunny hour or two that was to come. From the entire reef shelf came the faint, comical clatter of a million closing oysters and mussels. The awkward-legged crabs were rustling about for safe wet nooks in which to dream of more pleasant high tides. The small tide pools of perfectly calm, crystal-clear water sparkled in the natural matrix of rugged coral stems and rocks. My heavy reef boots crunched loudly on the eggshell mat of dainty corals. It was impossible to take a step without ending a thousand coralline lives, cracking a hundred shells into molluscan smithereens, or caving in the inner family sanctum of some tiny demoiselle fish.

The most pleasant and soul-satisfying collecting I have done has been in the tide pools of the seashore. On each occasion, when I have been in search of some particular tide-pool shell for study or drawing purposes, the hunt has turned into a combination survey of the marine animal kingdom and a tourist's excursion to a natural aquarium.

In addition to the numerous kinds of tide-pool gobies, blennies, and demoiselle fish, there are often young snappers, grunts, and squirrelfish trapped by the receding tide. The tiny inch-long demoiselle, with its bronze blues and gilded yellows, is the most beautiful of the shallow-water fishes, and yet the most ferocious in temperament. Take a step near the lair of a mated pair, and at once the tiny fish will dart out to attack the intruder. Although they are sometimes bold enough to attempt to bite, their small mouths, backed by a few ounces of body, can barely be felt.

One of the rare treasures of the sea was the scientific beachcomber's objective, but he did not count on the surprises that nightfall in Fiji could bring

By R. Tucker Abbott

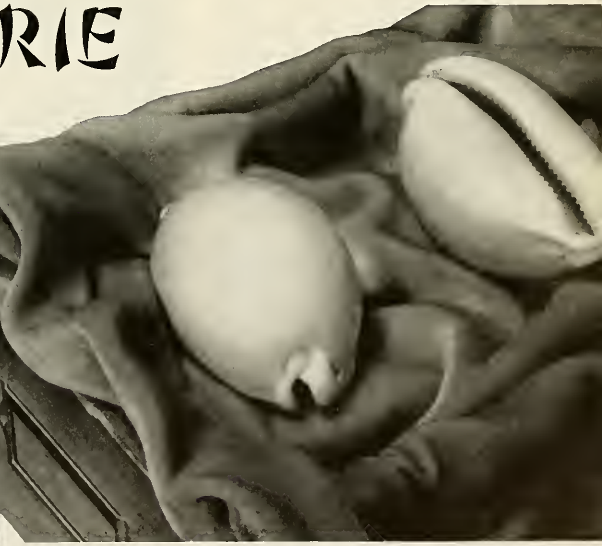
Associate Curator, Division of Mollusks, U. S. National Museum

Courtesy of Mrs. Anne Archbold

▲ The expedition yacht, "Cheng-Ho"

GOLDEN COWRIE

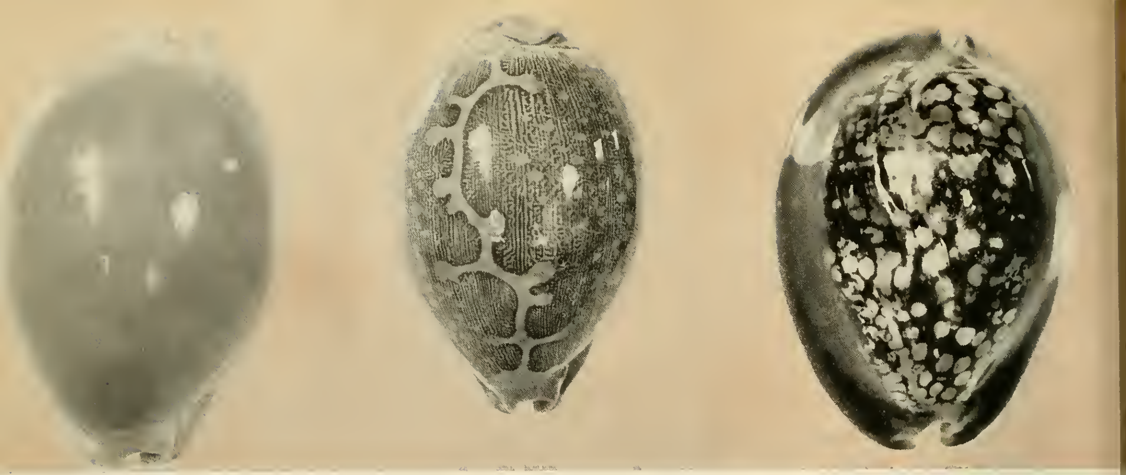
Courtesy of Harry S. Ladd



AMNH photo

▲ Our leading museums can boast of no more than 60 specimens of this much sought-after shell: the Golden Cowrie

◄ Somewhere among the coral-studded reefs of Fiji, the rare and elusive Golden Cowrie hides in undiscovered submarine lairs



▲ Six collector's items among the 160-odd known species of living cowries. All live in Fiji and other Pacific areas. *Left to right:* the Golden or Orange Cowrie, *Cypraea aurantium* Gmelin; the Map Cowrie, *C. mappa*

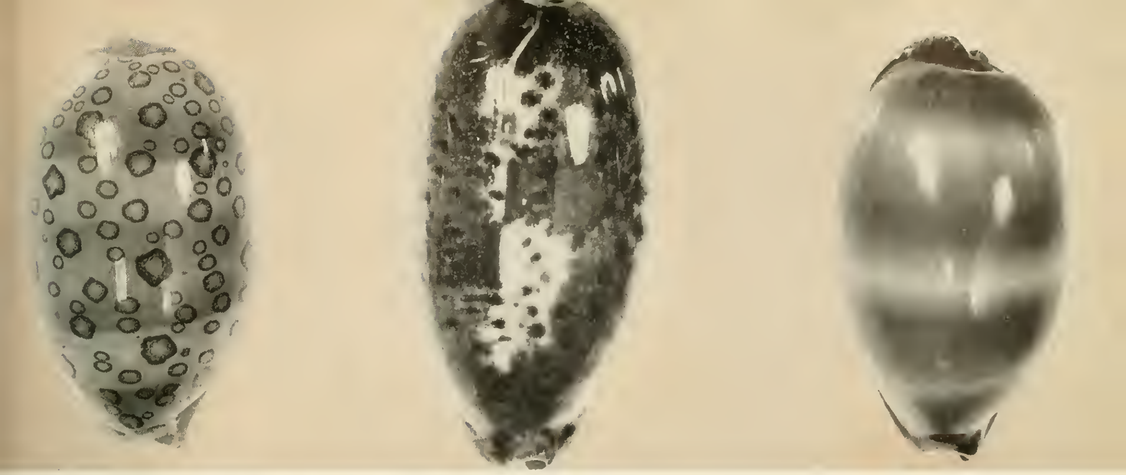
Courtesy of Mrs. Anne Archbold

▲ **Friendly Fijians like this old fisherman are the only people who have ever seen a live Golden Cowrie**

Other species of fish react quite differently to the presence of the splashing collector. The gray-speckled blennies sit motionless on the bottom, with bulbous eyes staring upward. The camouflage is perfect on gray sand or rock. Not until almost touched will the squatter budge—but when the spirit moves, he zips off with the speed of greased lightning, leaving a little whirl of sand behind. The rainbow-colored wrasse fish are entirely the reverse in temperament. Their inquisitiveness and insatiable appetite bring them swarming to each overturned rock in search of food. They will often mill around the collector with the boldness of a mosquito.

I worked slowly toward the outer fringes of the reef, turning over rocks and gathering specimens as I went. Each section of the reef has its peculiar habitat associations where certain species of shells are most likely to be found. Although the reef edge facing the open ocean is comparatively barren and most difficult to explore, it sometimes offers some surprising rarities that have ventured up from deeper waters. There are many natural haunts whose secrets are yet undiscovered by shell collectors, primarily because of their inaccessibility. For years, deep-water shells remained a great rarity. They are still highly treasured but are becoming more common in collections as modern dredging methods improve and as more amateurs take to this type of collecting. But it is not the inky depths alone that harbor undiscovered treasures. Coral reefs, such as these off Tunoloa, where, no doubt, the golden cowrie lives in some secluded chasm, are yet to be completely combed.

The cowrie shells have long been considered a family of aristocrats among the seashells. Novice collectors always marvel at the glossy, porcelaneous finish of these ocean gems and can scarcely believe that the colorful and lasting sheen of the shell is the work of the cowrie animal and not that of the buffing wheel and jeweler's rouge. Although many of the 160-odd living species of cowries are marked with extraordinarily bizarre patterns and characteristically display a wide range of hues, the golden or orange cowrie is outstanding for its simplicity in pattern and richness in color. The base or flattish bottom of the shell, where the slitlike aperture is lo-



Smithsonian photo

Linné; the Humpback Cowrie, *C. mauritiana* Linné. *On this page:* the Eyed Cowrie, *C. argus* Linné; the Turtle Cowrie, *C. testudinaria* Linné; and the Mole Cowrie, *C. talpa* Linné. Slightly less than natural size

cated, is a pure enamel-white. On either side of the aperture and a little within the opening, the sides are studded with orange teeth. On the sides of the shell and on the full, rounded top, the color is a solid cream-orange. In fresh specimens, the orange color is deeper and is highlighted by an almost golden glow. A four-inch golden cowrie without cracks or tarnish and resting safely in a drawer on black velvet cloth is a treasure sought after by many thousands of collectors.

In addition to its relatively large size and attractive appearance, the golden cowrie possesses four other qualities that place it among the high-priced seashells. It is rare in nature and uncommon in shell collections; its animals, eggs, and habits await scientific description; and it is connected with an interesting history. This is the same combination of factors that raises the sales value to several hundred dollars for such species as the Glory-of-the-Seas cone shell (*Conus gloriamaris* Chemnitz) and the white-toothed cowrie (*Cypraea leucodon* Broderip).

Since, as we are led to believe, the golden cowrie lives in fairly deep waters on the seaward slopes of fringing coral reefs, it is rarely captured except after violent storms. Although its geographical range extends from the Philippines to Melanesia, this species occurs in very localized regions. One such "pocket" exists among the small islands off the Surigao Peninsular of Mindanao Island in the Philippines, another along the southwestern coast of Viti Levu Island in Fiji; and there are still others of lesser importance throughout the other Fiji, Palau, and Solomon Islands. Undoubtedly, many other "nests" await discovery.

There are probably no more than 500 specimens in private hands in the United States and Canada. Our leading museums, all told, can boast of no more than 60. The aggregate of European and American collections probably outnumbers those in native Fijian hands by ten to one. A hundred years ago, the golden cowrie sold in Europe for over $100, but as the demand gradually declined they dropped to one fourth this value. The present-day American market is slightly on the increase with

Courtesy of Mrs. Anne Archbold

◀ THE EXPEDITION enjoys the simple hospitality of a Fijian village. *Left to right:* the author; Dr. Wesley Coulter, leader; Mrs. Anne Archbold, owner of the junk "Cheng-Ho"; Miss Mary Keegan, nurse; and the Reverend J. Ferris of Taviuni, Fiji

Courtesy of Mrs. Anne Archbold

< Two Fijian maids sporting ceremonial skirts of tapa cloth

sales ranging from $20 to $60, depending upon condition of the specimen. Throughout the ups and downs of the American market, the value of the orange cowrie has remained fairly constant in Fiji itself. As early as 1860, the Fijians had largely abandoned the custom of punching a hole through the shell and hanging it around their necks. In the early days, it was akin to a royal crown and was worn only by high-ranking chiefs. Today, it readily brings $2.00 or $3.00 when taxes are due or clothing and medicine are needed. An Indian shopkeeper becomes exceedingly patronizing when a troubled native rolls a golden cowrie on the counter.

Most cowries are nocturnal in habit, and long before the morning sunlight has reached the reef, they have crawled to safety under rocks and protective ledges. On the first occasion of tropical reef collecting, I turned over a slab of coral to find a large colony of what I at first thought to be some strange and beautiful nudibranchs or soft, fleshy sea slugs. I gave one a poke, and to my amazement it seemed to split down the middle by peeling back its colorful, fleshy cloak to reveal a glistening, gemlike cowrie shell! The fleshy mantle of the animal extends over the entire shell and is continually secreting thin layers of new and colorful enamel. In many species the mantle is much more attractive than the shell. Not only does it often display a wider range in colors, but in many species it is studded with numerous, frondlike fingers and bizarrely designed warts.

The eggs are laid by the females under protective rocks. The finger-shaped, horny, but soft capsules are deposited in small, round clumps. Each of these capsules contains several hundred microscopic eggs, which later grow in size, develop a tiny snail shell, and finally emerge as free-swimming veligers. The swimming period lasts for a few days, and then the young shed their tiny "hairy oars" and settle to the bottom to start their life at a normal snail's pace. Growth takes place in the normal spiral manner of a snail, with additional whorls or turns being added to the lip by the shell-depositing mantle. Just before sexual maturity is reached, the thin lip grows inward, thickens, and finally adds teeth. There are reports that the females sit over the eggs to protect them while they are developing. This is probably true, as I have rarely found egg clumps without an adult on top.

By some good fortune, when Nature was devising the exquisite patterns of rich chestnut dots and gray flecks for the tiger cowrie (*Cypraea tigris* Linné), she allotted to that large, handsome species the qualities of abundance and far-flung distribution. Whether collecting in Polynesia, Australia, the East Indies, or the distant shores of East Africa, I always look forward to meeting this old friend. The size, color pattern, and habitat preference differs in various localities. Here at Tunoloa, the tiger cowrie is uncommon, although only a few miles to the south in more protected waters it is rather plentiful. There the shells are larger in size, attaining a length of four inches, and at least half the population has shells with heavy blotches of cream-white. Recently, during a collecting foray in Tanganyika, East Africa, I stumbled across a colony of some 100 specimens nestled among the eelgrass leaves of a shallow flat. Few were over 2½ inches in size, and most were characterized by extremely dark coloration. Colonies of these dwarfs exist in widely scattered localities —Okinawa, Queensland, Halmahera in the Dutch East Indies, and Tanganyika. A giant race lives in moderately deep water in Hawaii.

It was now full low tide, and from a distance across a half-mile stretch of water I could hear the boom of the ocean surf on the outer reefs. The clear, sparkling breakers, the vast areas of freshly exposed corals, and the quiet, shallow waters ahead of me were all an incentive to desert this inner shore reef and head for the outer barrier. I set out hurriedly on a long, coral-crunching walk, for I knew that the tide was due to turn soon. At first, I passed patches of bushlike corals where the quiet waters had allowed them to develop to the extremes of daintiness and form. Nearer the outer reef, the corals were stunted in growth

◂ **FIJIAN WOMEN BEATING** strips of the bark of the paper mulberry tree to make *masi,* or tapa cloth

Courtesy of Mrs. Anne Archbold

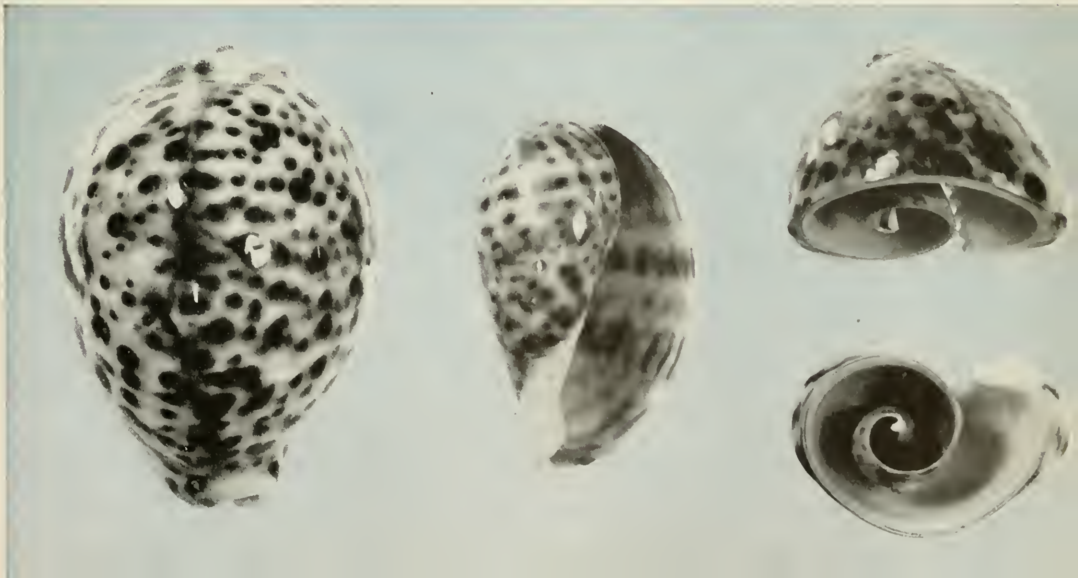
and much less imaginative in form. On the outer, wide rim of the reef, where at high tide the gigantic waves sweep over in great strength, the corals were worn and beaten down to almost smoothness. It was no effort to walk along this natural highway at low tide. The ocean edge of the reef was another story.

Here the ocean and reef are at their wildest. The great coral-lined fissures and bottomless holes are continually awash even at low tide. Occasionally I could glimpse a sudden flash of some colorful reef fish deep down in the blue water. The wildness of the outer reef is in direct contrast with the sleepiness of the lagoon-bordering reef. At low tide, as each wave smacks the coral wall, the reef trembles, and great geysers of spray leap up in the air, drift slowly in the wind for a few seconds, and then splatter noisily down on the reef. At half tide, the breakers are smashing over the top in swirling confusion, scouring each channel and pothole with ruthless efficiency. At high tide, the reef is completely covered by ten or more feet of sea, but the powerful, restless breathing of the sea swell continues to exert its frightful force.

Despite the great quantity of living coral and coralline algae, the unusually beautiful water holes, and the abundance of fish, sea fans, and other forms of marine life, I could find very few shells on this section of the reef. The tide was coming in at a smart clip, and all at once the little coral plateau on which I was collecting was awash. It always seems that the most interesting rocks are yet to be investigated when the tide is ready to turn. Each successive wave that rises from the ocean smacks the side of the reef a little harder, and each new gush of spraying water splatters nearer shore. From a cut in the reef a huge wave bulges up and spills out in every direction,

▾ **THE ENAMEL-COATED TIGER COWRIE grows in spirals like most snail shells. But upon reaching maturity, it curls in the fragile lip and develops thickened teeth.** *Left:* **top view of adult;** *center:* **immature specimen showing the aperture and fragile outer lip;** *right:* **an adult cut in cross section to show the manner of growth (*Cypraea tigris* Linné)**

Smithsonian photo



sending layers of water galloping along the reef plateau. There seems to be a sigh of relief from the reef as the cool, fresh sea water reaches the sun-baked corals and rocks. I always watch this process of marine rehabilitation with satisfaction, as if I were hosing a dry garden on a summer evening.

When collecting is over, weariness soon follows. Kicking through the water back to shore is like stomping through the autumn leaves on the weary way back to school. The joys of the holiday reef are memories, and the arduous task of cleaning and packing the catch lies ahead as a form of distasteful homework.

Beyond the grove of palms that rimmed the beach, the billowings of a distant storm pulled at their chains of lightning in the southern sky. The afternoon sun had long since lost its white hotness of noon. The storm was coming up from the south, and the stiff breeze that sent the waves crisscrossing sloppily up the beach slope was rushing with a clatter through the palm fronds. By the time I reached the mission house, the sun had dimmed behind the wisps of high cirrus that fanned out from the tops of the thunderclouds in the distance.

I walked to the other end of the village where a *masi* or tapa-making exhibition had been arranged for the benefit of our party by Father John Clerkin. Four or five native girls were squatted around a large grass mat on which were spread great sheets of white tapa cloth. From time immemorial the South Sea Islanders have developed and carried on the art of making this crude cloth from the paper mulberry tree. The newly made cloth is as soft as cotton. Today it is made for decorations, ceremonial dress, and tourists, but before the white man's introduction of the Mother Hubbard and cloth skirt, it was used more frequently as a wearing apparel. Tapa is used as bandages, swaddling, and bed cushionings and, in a thin form, smoked to a delicate tan, as a head wrapping for chiefs.

The bark of the mulberry tree is stripped from the stems in small sheets. A great number of these strips are pounded together with a little arrowroot paste as adhesive. Thickness and size may be varied by the number of smaller strips employed. The finished cloth, when dry, is decorated in complicated designs. Fireplace soot, a dye from the *lauthi* or candlewood tree, and the red juice of *tongotongo* berries are most commonly used in Fiji. Each island group in the South Seas has its characteristic design, and an expert can identify the origin of any piece.

Although the storm had partially dissolved to the south, a few scuttling gray clouds threatened directly overhead, and the girls picked up their tapa and scurried home. Father John and I sauntered back to the mission house. The air had turned cool, and the light breeze carried a smell of fish and fog that made me homesick for Cape Cod. Father John was silent, too, and no doubt he thought of the quays near Baile Atha Cliath (Belfast, Ireland) when the fog is drifting in from the sea. The urge to see home never lingered with me, for I knew that I would have to start back in not too many months; but for those who were ordained to stay and educate the natives, the transplanting was not without its moments of drought.

A goodly part of the next morning was spent aboard the "Cheng-Ho" in cleaning and preserving the previous day's catch. By the time I was ready to go ashore, the tide was already coming in, so I decided to make a short excursion into the hills for land shells. When headed for the reefs, my hopes had been highest for a golden cowrie, and when headed inland through the jungle growth, such thoughts were furthest from my mind. Yet, by odd chance, it was on this land trip that I obtained my first specimen.

I had been back in the hills working slowly up a fresh-water stream for three hours. Just as the Fijian dusk was beginning to ooze up from the glens and ravines, I called a halt to my collecting and started back for the junk. The narrow, soft-earthed path that wound in careless turns down the hill, the dark green forest that towered high and silently on every side, and the occasional faint whiff from some sweet-scented flower were all an inducer of slow walk and daydreaming. I thought of sailing-ship days when whalers first came to the Cannibal Isles. A sudden flutter of black wings and a series of eerie squeaks down the path a short distance ahead made me freeze in my tracks. A prickling sensation flashed up my back to the nape of the neck. Then I saw three giant fruit bats crisscross up into the air from a lone papaya tree and dodge away in the growing darkness.

It is uncomfortable to be frightened over nothing, and I quickened my steps in anger. A dozen times, it seems, I had started up a ravine or alongside a small stream that ran back into the jungle hills. The golden-yellow patches of noonday sunlight flickering through bright green foliage, the merry gurgle of water on the moss-bordered rocks, the tree ferns standing gracefully on the steep banks, the colorful flash of passing butterflies, the cheerful watery warble from a hidden bird—all these cast a fairyland spell that kept me climbing farther and farther. Collecting was often forgotten in my excitement to see what was around the next bend. I always knew when I ought to turn back, but often I was hypnotized by the strange beauty of the forest.

But eventually comes the moment when the soul that responds to beauty reaches a saturation point. Loneliness does not creep up slowly; it flashes on the scene. The back must be turned on the next bend. The inquisitiveness that is part of the road ahead becomes a memory of the long road back. The tough vines along the bank will not give way, the rocks in the stream are slippery and dangerous. A dozen turns are strangely new and seem recently placed there by some malicious fairy to lengthen the way home. Dusk is

Continued on page 144

"Poor-me-One"

The mystery of the jungle's most haunting sound—a call so human and so suggestive of hopeless sorrow that it baffled and distressed man for centuries

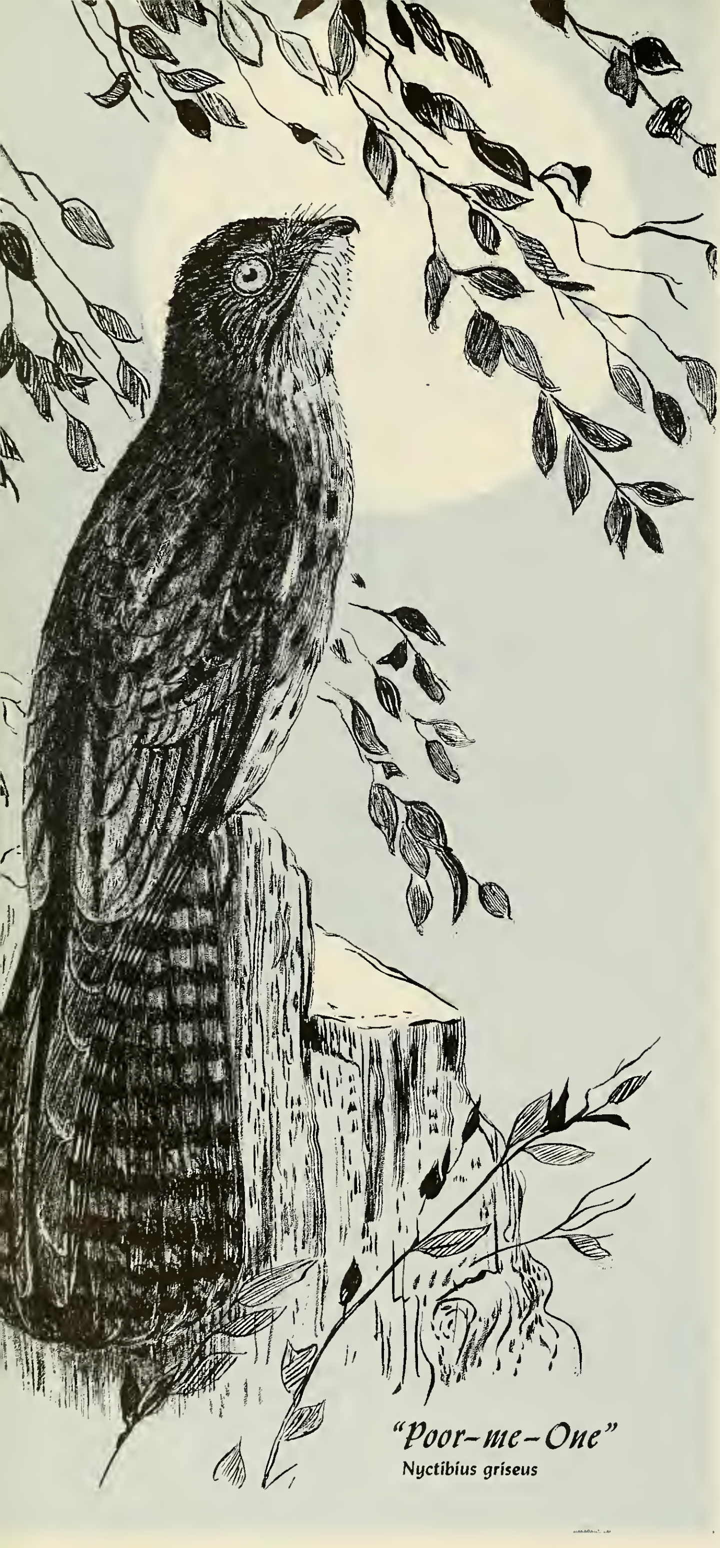
By WILLIAM E. LUNDY

MOST persons who love the jungle and turn to it for pleasure and relaxation find an absorbing pastime in listening to the myriad voices that come from its depths. So great is their number and variety that no single person could name all the creatures heard during a 24-hour period. It may take months or even years to discover the maker of a certain sound, but the thrill of solving such a mystery is ample compensation to the lover of nature.

Should a stranger find himself in our jungles in the Panama Canal Zone, and were he so fortunate as to be able to link all of the calls to their sources, he would find many strange and interesting "ventriloquists." He would hear the roar of lions and the barking of dogs coming from howler monkeys, the laugh of a fat man from a baby alligator, and the whistle of a boy from the snout of a young tapir. He would hear Swainson's Toucan calling with the voice of a frog; and the "dong" of a small silver bell would come from the throat of a tiny tree frog. One of the most deceptive sounds would be the soft birdlike call made by the kitten of the yaguarundi, or "Whistling Cat." No one would imagine that such a sound could come from a feline.

But one voice has fascinated me more than any other, and I guess that in all tropical America you could not find an animal that has perplexed and disturbed naturalists the way this one has. It is so utterly unique and weird that it has brought forth comments by many writers over a period of four centuries. It is heard only between dusk and daybreak, and few people can boast of having spied the creature in the act of making this uncanny call. When the ornithologist Dr. John T. Zimmer heard it in Peru, the natives told him that it was a lost soul—an *alma perdida*—and that he would naturally never be able to shoot it.

Dr. Frank M. Chapman sat spellbound as he listened to this call from the jungle just beyond the clearing of his "Tropical Air Castle" on Barro Colorado Island in the Canal Zone. It had been 37 years since he had heard it before in Trinidad, but he recognized it at once as the call of the "Poor-me-One," a name meaning in the Negro dialect of Trinidad "Poor me, all alone." When describing the experience in 1893, he said, "At first I thought it was a boy. It was a soft but loud, sad, flutelike note. I have never heard such a human sound from a brute before. It made the goose flesh rise all over me." Years later he said that the voice of this creature has such richness of tone



"Poor-me-One"
Nyctibius griseus

and is so suggestive of sorrow that ". . . in all the world of birds or man I have heard none sweeter nor sadder. So strongly does this song express human emotion that one thinks of it as a woman's voice—a deep, mellow contralto calling in hopeless grief."

Gonzalo F. de Oviedo y Valdés, first chronicler of the Indies, is believed to have had this call in mind when four centuries ago he described a sound differing from that of all other animals, beginning with a high note and descending for six points: "Ah, ah, ah, ah, ah, ah."

Doubtless it was the same call that Charles Waterton, an English naturalist and explorer, described in South America in 1816 as being so remarkable that having once heard it, you will never forget it: "When night reigns, . . . you will hear this lamenting like one in distress . . . A stranger . . . would say it was the departing voice of a midnight murder victim, or the wailing of Niobe for her poor children, before she was turned to stone. Suppose yourself in hopeless sorrow, begin with a high note, and pronounce, 'ha, ha, ha, ha, ha, ha, ha,' each note lower and lower, till the last is scarcely heard, pausing a moment or two between every note, and you will have some idea of the moaning."

A few years later an English clergyman, Charles Kingsley, told of an experience in British Guiana. "Then something . . . —and I do not deny that it set me more aghast than I had been for many a day—exploded I say . . . with a shriek . . . such as I hope never to hear again . . . after which, happily, the thing, I suppose, went its wicked way, for I heard it no more . . . for most ghostly and horrible is its cry."

A Balboa resident once told me that she had heard the cry for the first time when she was alone in her home on Morgan Avenue and that she thought it was the wife of a neighbor being beaten unmercifully. She, too, said she hoped never to hear it again.

All agree that the call of "Poor-me-One," once heard, is not likely to be forgotten. Residents of Quarry Heights and sections adjacent to Ancon Hill are fortunate—or unfortunate, according to the point of view—in that they may be awakened at daybreak by this voice of the jungle. Sometimes it is heard from nightfall till midnight. On a still night, the cry can be heard for half a mile; and on moonlight nights, it may come at intervals throughout the night. I first heard the call from Ancon Hill some fifteen years ago. It so closely fitted the description given by Dr. Chapman that I knew it must be the "Poor-me-One." I have heard it many times since.

Explanations

There has been considerable difference of opinion as to what creature makes this call. The historian Oviedo gave credit to the sloth. Probably he was passing along the belief of the Indians. In any case, this myth has been handed down for the past four centuries and is still believed by many today. On the night that Dr. Chapman first heard the call on Barro Colorado, he called to the keeper, "Donato, what is that calling." The reply was, "*Perico Lijero,*" a nickname given by the early Spanish visitors to the three-toed sloth. It was the first time that Dr. Chapman had known Donato to be wrong. A laborer from southwestern Colombia gave him the same reply, showing how widespread this myth has become.

In 1893, when Dr. Chapman first entered the forests of southern Trinidad, he had been told to listen for the song of the two-toed anteater. The notes of the song were described to him so well that when he heard it from the forest he did not doubt its author. After observing a living anteater for some weeks, however, he began to doubt the local belief that it was the "Poor-me-One." A year later he returned to Trinidad and, in company with Albert Carr, a local naturalist who had solved the mystery, actually saw a "Poor-me-One" calling.

What animal, then, had frightened, bewildered, and moved with deep emotion so many jungle travelers?

It was a bird—of the goatsucker group.

If I had had any lingering doubt as to the correctness of this, it would have been wiped out just after daybreak on June 10 of last year, when I was awakened by an unusually loud cry. From my bedroom window I could see a bird perched on the top of a pole some 40 feet away and silhouetted against the sky. It seemed incredible that this bird, with a length of hardly more than 12 inches, could be the author of a cry of such volume; yet as I watched it, it repeated its loud six-note call. Its body vibrated perceptibly with the force put into each note. Then it flew into the trees across the street, where it called again. The bird returned at dawn on June 12 and again flew away after calling twice. From then until 3:00 A.M. on July 4 it was seen eleven times perching on the pole, preening its feathers, and occasionally darting out a few yards after insects. On two occasions it remained on the pole until it had sung its pathetic song through seven times. After July 4 it was not seen again. Probably the fireworks on that evening had frightened it away to the jungle growth higher on the hill.

Heard from a distance of only 40 feet, the call of "Poor-me-One" has, in addition to the six notes already described by others, a sound like a gasp for breath following each note except the last. One person who had heard it from a short distance thought that the sound was made by flapping the wings against the perch between the notes of the call. I believe it to be made with the throat. In contrast to its famous—or notorious—cry, it gave another cry several times, low and very deep-throated yet very soft, sounding like "Oo-ah, oo-ah." I doubt that it would be audible at a distance of 100 feet.

Our Panamanian "Poor-me-One" is not consistent in the number of notes used in its song. While the call is usually composed of six notes, the bird has been known to utter eight notes, and several times only four were used. And though I do not yet have visual proof, I am convinced that on rare occasions its cry is reduced to one long heart-rending wail, quite as disturbing in its effects on the listener as is the six-note cry.

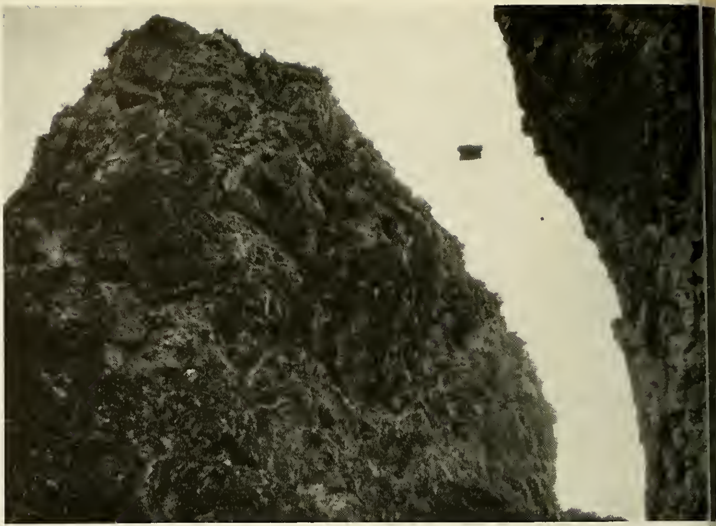
Unlike many of its relatives (the nighthawks, whippoorwills, etc.), which perch horizontally on limbs of trees or on the ground, "Poor-me-One" prefers an upright position almost parallel with the perch.

Almost as singular as its calls are the nesting habits of this strange bird. Having selected, through design or instinct, a broken tree stump whose coloring blends well with its own, "Poor-me-One" deposits a single egg in a cavity so placed that it can be incubated while the bird perches in an upright position. Sitting there with its tail pressed firmly against the trunk of the stump, its eyes closed to mere slits, its neck stretched to full length, and its head pointing upward, it becomes to the casual observer a part of the stump itself.

No feathers, twigs, or down line its crude nest, for so well is the cavity selected that little or no room remains for more than the egg. Speaking of a nest that he found in Trinidad, Mr. Alec Muir said, "How the bird managed to place the egg there I cannot imagine. The egg exactly fitted the cavity. There was no room to spare. It could not be moved from side to side, but I could revolve it gently with my fingers."

Within a day or two after hatching, the young bird has assumed the upright posture of its parents, its creamy-white down blending as a patch of fungus on the stump. So tenaciously does it cling to the nest that during its early life it may not be pulled loose without danger of damage to its soft body.

Yes, this is a most extraordinary bird. If you ever hear it call, you will never forget it. Many have fallen under the spell of the jungle—its sights and sounds and smells. But those who have heard it agree that the most haunting song to voice the jungle's timeless mystery and pathos is the call of the "Poor-me-One."



➤ Split Rock, or Fortress Island, off Unalaska Island, on top of which four mummies were found by the Stoll-McCracken Expedition, mentioned in the accompanying article

Harold McCracken photo

MUMMIES FROM ALASKA

Adventure and misadventure were partners to those who searched for the strangest things to come out of the North

By Alan G. May

Vice President, North Central Washington Museum Assn.

When mummies are mentioned, most people's thoughts turn automatically to Egypt. Undoubtedly this is because the Egyptian mummies are by far the most spectacular and because they represent the highest known development in mummification. More literature can be found relating to Egyptian mummies than to all the rest of the mummies in the world added together.

Alaska is one of the many places in the world where mummies are to be found, though the mummies from Alaska have little in common with those of Egypt. In both cases an artificial process of preservation was used and the internal organs were removed; beyond this there is little similarity.

Early explorers of Alaska, as far back as 1790, reported that the Aleutian Islanders had a strange habit of mummifying their dead. Their information came from the Aleuts, not apparently from direct observation.

Father Veniaminof, a priest who was later made Bishop of Alaska by the Russians, lived for ten years among the Aleuts and became their friend and mentor. In his journal he recorded the process of mummification as told to him by the Aleuts, and this is the earliest account from Alaska that we have. It was 52 years after Veniaminof arrived in Russian America that the first mummies from his beloved islands reached the United States.

In 1875, twelve mummies from the Aleutian Islands arrived in San Francisco, through the courtesy of the Alaska Commercial Company. The company had instructed their men to procure, whenever possible, any material of scientific interest that they came across during their travels. The twelve mummies had been found by the captain of a small ship when it put in at Kagamil Island to pick up some hunters.

It was not until the American Museum's Stoll-McCracken Expedition of 1928 that the next mummies were brought out of Alaska. The expedition's archaeologist, Dr. Edward Weyer, Jr., now Editor of Natural History Magazine, and Junius Bird, who has for many years been on the staff of the Museum's Arthropology Department, reported the finding of four mummies on Split Rock, a small and precipitous island in the Aleutian chain. These mummies were found in a most unusual wooden sarcophagus on the summit of the island and had to be lowered by ropes.

No further mummies reached the United States from Alaska until 1936. At that time the late Dr. Aleš Hrdlička of the Smithsonian Institution commenced an archaeological survey of the Aleutian Islands which continued through the years 1937 and 1938. During this period a large number of mummies were found. The writer accompanied Dr. Hrdlička throughout the three years' exploration.

One of the several objectives of these expeditions was the search for mortuary caves containing mummies, and considerable preparation was made for this phase of the

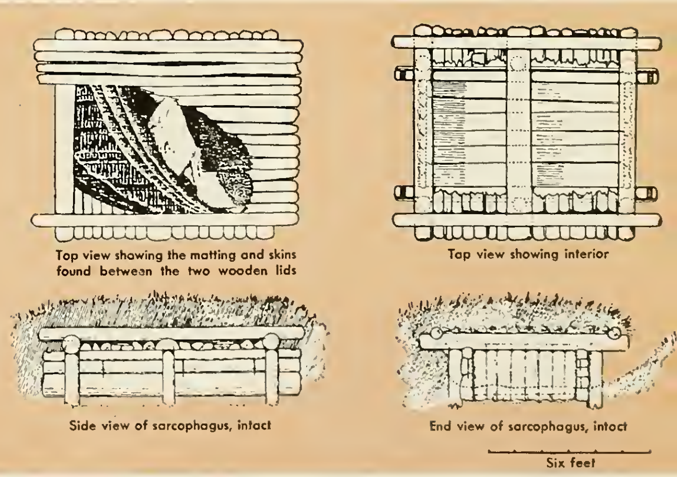
◂ The mummies from Split Rock, like the other Aleutian mummies, were doubled up. They were clad in garments of grass matting

▾ Charles Stoll and Harold McCracken holding the flag of the Explorers Club over one of the mummies from Split Rock

Harold McCracken photos

◂ The mummies were found in this elaborate driftwood sarcophagus beneath the sod. Junius Bird is here seen removing the top layers

▾ A drawing showing details in the construction of the sarcophagus and the layers that formed the top



Top view showing the matting and skins found between the two wooden lids

Top view showing interior

Side view of sarcophagus, intact

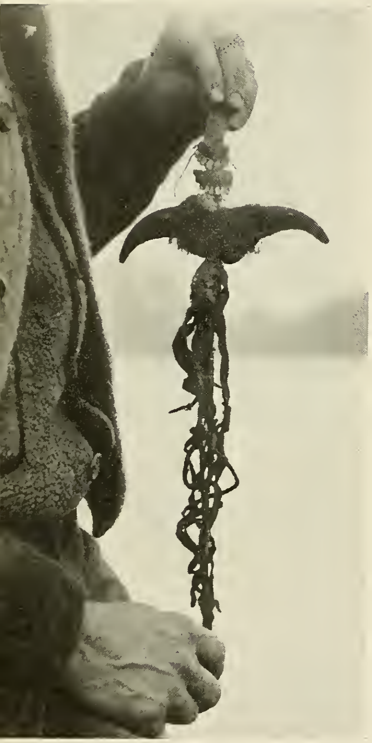
End view of sarcophagus, intact

work. All available records were examined for possible clues to the locations of mummy caves. Whenever possible, information was obtained from the older Aleuts who claimed knowledge of the caves, as well as from Alaskan old-timers. The late Reverend A. P. Kashavarof of the Alaska Territorial Museum, Juneau, searched through a number of old Russian books and manuscripts, translating and typing parts that might be of use in the quest. Veniaminof's report concerning mummy caves on Kagamil and Tanginak Islands was, of course, well known. Tanginak, now known as Ship Rock, was a familiar sight to the thousands of serv-

➤ **Skulls** found in a rock shelter lower down on Split Rock Island

Harold McCracken photos

▼ **Possibly** the emblem of a chief or a sorcerer: an ornament made of bear's teeth and human teeth, found with the mummies on Split Rock



icemen stationed at Fort Glenn on Umnak Island. Fort Glenn was renamed Cape Air Force Base in 1948.

Most of the leads and clues were followed up during the three seasons spent in the islands. Many proved fruitless. It was only at the two locations specified by Veniaminof that mummies were actually found in the caves.

Kagamil is one of a group of five islands known as the Islands of the Four Mountains, lying to the west of Umnak. The island is small, with a rugged rocky shore line, and it has no harbors. Smooth seas are essential for a landing, but it is a rare occasion when the waters are really calm. Adding to the difficulties of the Coast Guard in taking the party to Kagamil was the fact that the waters around the Four Mountain group were not accurately charted in 1936.

Further proof, if indeed such was needed, of the existence of mummies on the islands was forthcoming when the expedition was working on Kiska. Dr. O. J. Meury of the Biological Survey stopped at Kiska to present to Dr. Hrdlička two mummies which he had found on Kagamil a few days earlier. Fortunately, too, Dr. Meury was able to describe a definite landmark near the cave—one that could not be missed. About one quarter of a mile from the cave was a large *solfatara*, or vent in the cliff from which bellowed forth gases and steam. This was valuable information, for it saved much time and searching on arrival at the island some weeks later.

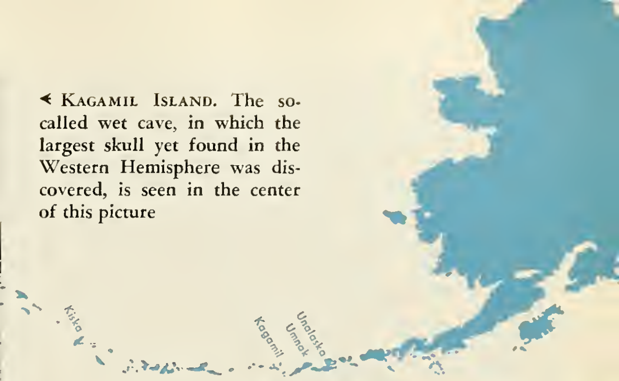
Because of high seas and an impenetrable fog, the first attempt to reach Kagamil ended in failure. However, although the weather conditions were far from favorable, a difficult landing was accomplished near the *solfatara* on the second attempt a few days later.

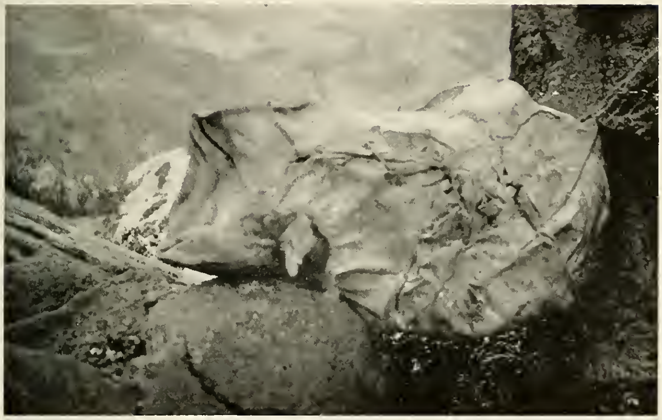
Many small jets of steam issued from the rocks just above the water line. Boiling water gurgled among the boulders and crevices, and in some places the ground was warm. Near the top of the cliff, where moss was the only vegetation, both the ground and the moss were warm to the touch. Each footprint in the soft moss left a small plume of steam.

Not far from the *solfatara*, the cave was found at the base of a vertical cleft in the rock cliff. The interior of the cave was of irregular shape, with a ceiling so low that it was only possible to stand upright at the entrance. Loose rocks, boulders, a few human bones, and bits of matting lay on the uneven floor, which was a few feet below a natural rock shelf. The poor light caused by this rock shelf and the low ceiling made flashlights most valuable. Throughout the cave—in the ground, on the boulders, and adhering to the walls—were quantities of a dirty white, near-crystalline material—perhaps a form of siliceous sinter. It is not impossible that at some

Alan G. May photo

◄ KAGAMIL ISLAND. The so-called wet cave, in which the largest skull yet found in the Western Hemisphere was discovered, is seen in the center of this picture





▲ A MUMMY in its wrappings. The grass rope that bound it was lost in transportation from the cave to the shore

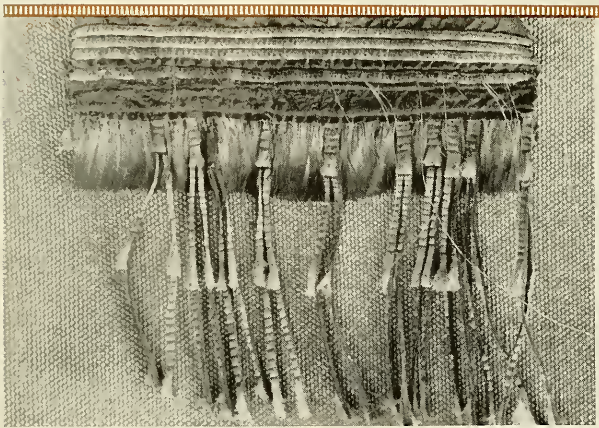
► THE *solfatara* or steam vent on Kagamil. Steam blew continuously from this opening in the earth, with a loud noise

time in the distant past this cave was another large *solfatara,* the whitish substance having been deposited by the gases.

We discovered our first mummies just below the floor level. They had apparently been covered by natural causes over a long period of time. Foxes had denned in the cave, adding to the debris; they had also chewed on some of the mummies. Aside from the fact that a large number of mummies were found together, one on top of another, there was no apparent system of placement. There were a few isolated mummies; sometimes two or three were found tucked away in some corner or niche. It would seem that after the main depository was full, mummies were placed wherever room could be found for them in the cave. Two kayak frames were uncovered in one recess. Rumors have been frequently heard of persons who claimed to have seen mummies holding paddles in their hands, sitting in kayaks or bidarkas in burial caves. However, there were no mummies in these kayaks.

Many mummies were discovered, mummies of men and women and many children. As the excavations went deeper, the ground became warmer, until near the bottom it was too hot for comfort. We frequently had to pause for a breath of fresh air at the entrance because of the dust stirred up by the work. Near the center of the cave on the rock bottom was a large slab of stone that took the efforts of three men to lift. Below this, in a hollow, were found the remains of a multiple cremation burial.

Buried with the mummies in the accumulated debris were many beautifully made wooden bowls (*kantags*). Other specimens uncovered were arrow or dart points of stone and bone, stone knives, mummified birds, and a large number



Alan G. May photos

▲ PART OF an elaborate fringe from an Aleutian mummy garment. It was made from fur, animal skins, breast skins of water birds, feather, and hair. Red, gray, black, and white hair was used in it

▲ A WOODEN BOWL from one of the mummy burials, left there for the use of the dead in the afterworld

of bird wings. There were pieces of skin from the sea otter and the fur seal, as well as paddles, parts of wooden slat armor, decorated wooden shields, spoons, and labrets, or lip plugs. Some of the latter were inlaid with shell. There was also a large amount of matting as well as an extensive variety of bags and baskets. Some of this material was in excellent condition; other pieces were partially disintegrated. The woven articles, all of twined construction, showed an infinite variety of design as well as numerous differences in the weaving technique. The best of these are considered the equal of any comparable material from any part of the world.

All the mummies were in the contracted position, with legs close to thighs, chin resting on or close to the knees, hands over or near the face. The abdominal organs of most of them had been removed through the pelvis, one or two through the chest. None of them, however, were stuffed with grass as reported to Veniaminof by the Aleuts. Some Russian accounts state that after evisceration the body was rubbed with oil for many days. Other stories have it that the body was placed in running water in order to remove the fatty matter.

Animal or bird skin parkas were wrapped around the bodies, and some of these garments had remarkably elaborate fringes. Around the parkas were wrapped two or more finely woven mats of varying design. These were covered by a sea lion or seal hide, and the bundle was then encircled with a net of braided sinew. Some of the mummies lacked the sinew net and were tied with a thick, coarse grass rope; a few were tied with kelp.

At the time of the discovery, there was no opportunity for opening the mummies for inspection. On examination at Washington at a later date, Dr. Hrdlička pointed out that two physical types were present. One of these matches the historical Aleut, who are short, round-headed people. The other, a comparatively tall, long-headed people, he thought of as pre-Aleuts. If this physical difference can be related to a pre-Aleut culture, then the practice of mummification must have existed long before the advent of the Russians, who found Aleuts on the islands when they arrived. While it is unknown how the practice of mummification commenced in the Aleutians, it is quite possible the custom may have originated among pre-Aleuts and have been carried on by the later people.

The individual mummy package or bundle was small. In a few cases it was found that bones had been broken, apparently to facilitate the wrapping of a small, neat compact bundle. When we packed the mummies for shipment, we found that with care two adult mummies could be packed in a fifty-gallon herring barrel.

Another large mortuary cave containing mummies was discovered not far distant on the following day. Water dripped from the roof of this cave, and the dirt floor was damp. Consequently, the material found was not, generally speaking, in such good condition as that in the hot cave. Blocking the entrance was a massive boulder that had fallen from above, causing a very subdued light. The cave tapered from high at the entrance to low at the back, broad at the front to narrow at the rear. On the floor were many skulls, some partially mummified, and long bones dragged there by foxes.

Among the numerous skulls picked up from the floor was one that was particularly large. When measured in Washington, D. C., this skull proved to be the largest ever found in the Western Hemisphere. At that time it was the second largest normal skull ever recorded anywhere. It had a cranial capacity of 2005 cubic centimeters, which is over a third larger than the average for modern man (1450 cc.). There was no evidence of giantism, such as would have been indicated by abnormal thickening of the bone, nor were there any signs of hydrocephaly, which would have caused malformation. As there were no other extra large bones in the cave, it seems highly improbable that the skull belonged to any giant. How or why an Aleut developed such a huge skull is indeed a mystery that may never be solved.

Along one side of this wet cave mummies were stacked like cordwood. Added driftwood planks had been placed between the layers of mummies, which were stacked four high—five high if you counted an odd mummy placed on top of the fourth layer. The first or bottom layer was below the floor level of the cave. Twenty-four gunny sacks full of material were gathered before weather conditions necessitated a hurried and exciting departure from the island.

We visited the island again in 1937 and 1938, for the work had not been completed. More material of a similar nature was obtained, though in smaller quantities. Further searching along the shore line did not bring to light any more caves, although we located several rock shelters that had been used for burial purposes.

Again in 1948, the writer once more landed on Kagamil with the Peabody-Harvard-U. S. Navy Expedition. Since 1938, the hot cave had been re-explored by unknown persons; only some fragments of matting and a few other items were found. Limitation of time prevented a visit to the wet cave. It was noticeable that the volcanic activity of the island had lessened considerably during the intervening ten years.

Ship Rock lies in the pass between Unalaska and Umnak Island. Earlier in the season of 1937 an attempt was made to land here, but strong tide races prevented the ship from reaching the rock. It is a difficult spot, and in 1948 two men are said to have been drowned while attempting to reach Ship Rock in a small boat from Umnak. But on the last day of the 1937 season, our second attempt succeeded with unexpected ease.

Here, under a tall leaning cliff, more mummies were found. These had been carefully laid on whale scapulas (shoulder blades) and pieces of whale skulls. They were sheltered from the elements by a sloping wall of driftwood covered with sea-lion hides. Part of this protection had fallen away, leaving some of the bodies exposed to view. Though there were no foxes on this little island, once again the mummies had been despoiled—this time by puffins. Thousands and thousands of these comical birds, often called sea parrots, nest on the rock. They had eaten parts of the mummies and had burrowed in among them to nest.

Altogether from this rock shelter and from the hot and wet caves of Kagamil, some 65 to 70 mummies were obtained, as well as over 200 skulls.

Possibly there are still more caves in the Aleutians where mummies may be found. Records mention some, and rumors tell of many more. Perhaps some of these caves have been sealed forever by earthquakes, which are not uncommon throughout the islands. During the three seasons we spent in the search, many islands were visited. Many a mile was covered on foot over the tundra and along the shore, and many hundreds of miles were traveled by ship. Numerous caves were found besides those on Kagamil and Ship Rock. Some contained burials, some were empty. It is interesting to note that of all the information we gathered before commencing the search, it was only that given by Veniaminof, well over 100 years ago, that proved to be correct.

Without the wholehearted support and generous assistance given by the United States Coast Guard, including transportation to the various islands, these investigations would have been impossible. Indeed, had it not been for the help rendered by some of the officers and men of the cutter "Chelan" in transporting material on their backs over rough terrain, a considerable part of the finds from the wet cave would have had to be left behind.

At the conclusion of the last season's work, Dr. Hrdlička turned to the members of the party and said, "You have seen the like of which you will never see again." This may be only too true.

▾ **Ship Rock**, in the pass between Unalaska and Umnak Island, where additional mummies were found

Alan G. May photo

▲ A LARGE PERCENTAGE of the population of Zanzibar consists of Hindus and other peoples from southern Asia. Many of them do not cover their faces with he yashmak or black *bui-bui* as do most of the Arab women

▼ THE SWAHILI FISHERMEN go far out to sea in crafts like this to troll for giant horse mackerel and sharks. Dried shark's flesh is one of the staples of their diet

Zan
ISLAN

Wander through its murk
of the Ancient East, where
adventure is as unpredict

By RUSSELL BARNETT AITKEN

All photographs by the author

IN lieu of a magic carpet, our propeller twinkled cheerfully in a tropic sun, as the ground flew out from beneath us and coconut palms whizzed by like subway stations on a Bronx Express. From the air Dar-es-Salaam looked its name, Haven of Peace, with its candy-box Tyrolian architecture, its tidy lawns, and methodically plotted streets. A fleet of native catamarans lay neaped by the tide on a wide beach, while at the edge of the river mouth the hulk of a large ship, orange in its rust, was half submerged where the Germans had sunk it decades earlier.

Little patchwork islands in coats of forest green trimmed with ochre sand sparkled in the turquoise frame of the Indian Ocean as Tanganyika faded into the west. Twenty-two miles beyond the nose of the plane, we could now see the vague outline of our destination—the Sultanate of Zanzibar, a mystic coral isle right out of the *Arabian Nights*.

In this romantic spot on the waist-line of the world, a white-bearded

ibar–

JEWEL

bazaars on the Threshold
ght, the next smell, the next
face behind the yashmak

ruler lives amid oriental splendor in a city permeated with the fragrant odors of spice, frankincense, attar of roses, and the stink of dried shark's flesh. His ensign is a red flag, such as means "danger" in America—a proper color for this Muscat metropolis, where veiled Omani women glide by like dark wraiths, and turbaned Arabs carry daggers in their belts.

As if to set the stage for our introduction to Zanzibar, a venerable Arab was traveling as co-passenger. His handsome head was wrapped in the white *kilemba* worn by men of learning and piety, and he wore a *joho*, a black robe trimmed with gold braid, over an immaculate *kanzu*. Craning my neck, I could catch a glimpse of the silver-filigree hilt on his *jambia*, the J-shaped dagger. It was obvious that our traveling companion was V.I.P., and if his beard hadn't been black, I would have surmised that he was the Sultan himself. The contrast between this Haroun al Raschid and the modern aircraft was startling.

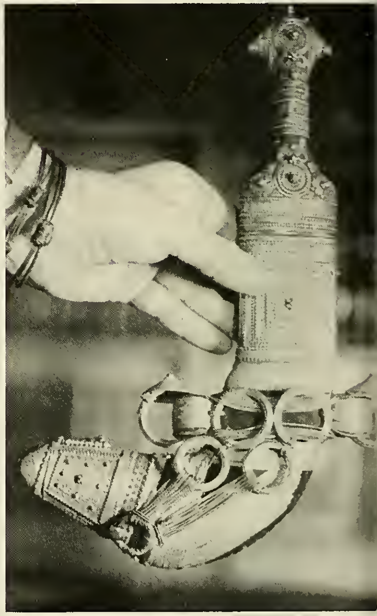
When at last I peered down upon the city that veteran globe-trotters have called the most fascinating in

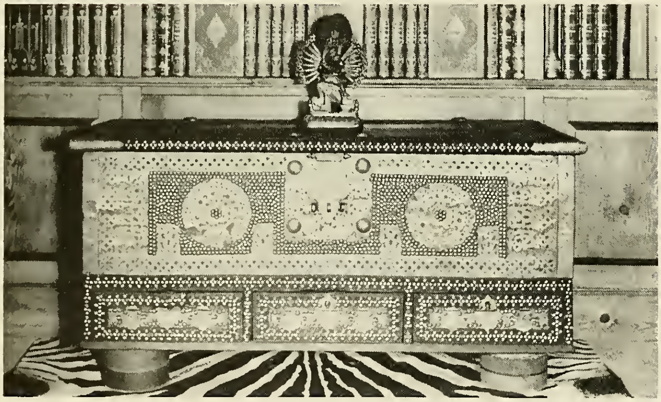
▲ THE ALLEYS OF ZANZIBAR take on a sinister aspect as evening falls. With crime on the increase over Africa, they are unsafe for unescorted tourists. Zanzibar police are efficient, but the town is a labyrinth of narrow streets

▼ ACROSS FROM THE SULTAN'S PALACE, two Zanzibaris were haggling with a Swahili fisherman, critically inspecting his catch as they prepared to buy direct and avoid the middleman

◄ **The Beit-el-Amani,** "House of Peace," is one of the most handsome museums in Africa. It houses many interesting relics of Zanzibar's bloody past. Original letters of Livingstone, Stanley, Speke, and Sir Richard Burton are displayed here, as well as craft work and weapons used in many wars

▼ **Successful Arabs,** men of substance, wear the J-shaped dagger called a *jambia.* Its ebony handle and scabbard are exquisitely decorated in silver filigree. Pure gold threads are used on the belt. Even more than the gorgeous appearance, they prize a blade of age and quality. It is a short, curved blade designed for disemboweling an enemy





▲ **This is the** *kasha la njumu,* the "Zanzibar Chest," purchased by the author in the bazaar. It is made of teak with copper and brass overlays and decorative trim of brass nails. These chests were made in Surat, India. Ancient Arabs, distrusting banks, used them for protecting money and jewels

the world, all I could think of was the description of it once rendered by a British resident: "There are worse places than Zanzibar—but not much worse. The place is so windy that tourists are blown right up the beach into the Africa Bar, which serves whiskey with lizards in it. You'll be sorry if you don't visit Zanzibar—but you'll be equally sorry if you do." I was prepared for anything as the plane skidded to a landing.

The town, as we approached it, appeared flat, congested, and dormant in the midday sun; but the instant the airport taxi halted, I inherited a dragoman who popped out of nowhere like a jinni. He was a weathered Arab of indeterminate age, whose pock-marked face radiated emotions ranging from good will to avarice; and he attached himself to me as if a contract had been signed.

I followed him down toward the lapis-lazuli sea. Once outside the labyrinth of choked alleys, I found the town a mass of pastel houses and palms, a tropical garden perched on a sturdy base of coralline limestone, a city resting peacefully in the ashes of a bloody past. Fierce corsairs from the far-off Kingdom of Oman had fashioned her into a domain so powerful and ruthless that a contemporary proverb boasted of it. "When the flute is played in Zanzibar," it said, "all Africa east of the Lakes must dance."

Zanzibar Town is the capital of that once-mighty Empire which today is a protectorate of Great Britain. Its Sultan governs under advice of a British Resident, and its current ruler, Seyyid Sir Khalifa bin Harub bin Thuwaini, G.C.M.G., K.B.E., is an able and just descendant of the royal and belligerent dynasty of Al-bu-Said. His dominion includes Zanzibar and a strip of coast ten miles wide from the Tanganyika border to Kipini, as well as the Lamu Archipelago and a small section near Kismayu. To the humble Moslems of Africa's mainland their potentate is virtually Lord of the World, and his storybook capital represents the Paris and Mecca of East Africa. They do not refer to him as "Sultan," since *sultani* is a Swahili word used in addressing petty upcountry tribal chiefs. Instead they call him "Es Seyyid" ("The Prince").

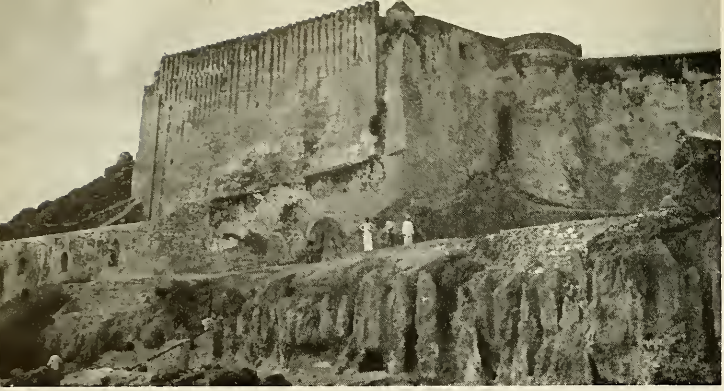
We wandered past the Beit-el-Ajaib, the House of Wonders, which now holds the Government Offices, and ended up at the Town Palace of the Sultan, an imposing crenellated building, white as alabaster, with iron grille gates and Arabic insignia on the gateposts. In the courtyard a houseboy was polishing brass urns and giant trays which glittered like pure gold. When an armed askari eyed me suspiciously, I took the hint and departed, crossing the street to the quay where two Arabs were haggling with a Swahili fisherman whose catch was still jumping around in his nets.

Heading for the Bazaar, we turned into narrow alleys reminiscent of the Casbah and traversed a Street of a Thousand Smells, where it was necessary to dive into the sanctuary of a doorway to avoid being run over by bicycles, oxcarts, hand-drawn hamal wagons, and porters with heavy boxes stacked six-high on their heads. Here the heat was oppressive, sickening.

In the cluttered confusion of the Bazaar, wily Hindus hold in contempt anyone who pays the first price asked, and it was amusing to bargain with them. In one decrepit shop I found what I was looking for —a magnificent brass-bound, nail-studded teak chest about four feet long. This was a *kasha la njumu*, the famed "Zanzibar Chest," made long ago in Surat for Muscat Arabs, who distrust banks. It is rated the most beautiful of all the exotic chests of the world, and authentic old ones are scarce and expensive. After making arrangements for its delivery to New York, I prowled the other stores and looked at silver-mounted tiger claws, daggers, swords, silver Koran cases, and dainty filigree jewelry.

It was only when we trekked to the native market that I became fully aware of Zanzibar's cosmopolitan conglomeration. Here descendants of the early Muscatees and their mixed progeny, the Waswahili, rub elbows with camel drivers from Baluchistan, silver workers from Ceylon, Persians, Greeks, Egyptians, Levantines, Japanese, Chinese, Khojas, Parsis, and Goanese. Arabs outnumbered the others. The babel of the many languages would drive any linguist insane. There were Comorian, Mafazi, and dignified Omani aristocrats. Swahili bibis in brilliant-hued *kangas* swiveled their gener-

▲ **After a night of tropic rain, the alleys of Zanzibar Town are full of puddles until the hot sun can reach and dry them**



◄ MOMBASA, ON THE COAST of Africa north of Zanzibar, also falls under the dominion of Zanzibar's Sultan; and his red flag, not the Union Jack of the British, flies over old Fort Jesus. This structure was built in 1593-5 by the Portuguese and was wrested from them in long and bloody wars by the Arabs. Indeed, the island on which the fort stands is called *Kisiwa Mvita,* "Isle of War"

ous hips alongside slim Arab women whose faces were concealed by the inevitable yashmak, while sultry-eyed Indian girls with cameo profiles and priceless gems glittering on their foreheads stared insolently at rakish dhow sailors in tattered silks. Perspiring humanity made a pulsating multicolored mosaic of this Crossroads of the Ancient East.

On the counters of the market a bewildering variety of strange-smelling things were displayed, and customers flocked to fruit stalls heaped high with pomegranates, guavas, sapodilla plums, custard apples, Chinese dates, loquats, pineapples, watermelons, and tamarinds. One popular booth was dispensing betel leaves and sliced areca nuts, a mixture which is colored with *katu* and chewed, with a little slaked lime added, like tobacco.

I followed my quivering nostrils to the fish market, where myriad seafoods were being hawked—giant turtles, squids, horse mackerel, whip rays, repulsive *bêche-de-mer* sea slugs, beautiful parrot wrasses, and streamlined barracoutas. Once not so long ago one particular fish was purchased here for a few pice, only to be immediately resold for 7000 rupees when a superstitious son of the Prophet discerned what looked like a sacred passage from the Koran in its scale pattern. One stall, ostracized and segregated, offered ptomaine by the pound—foul-smelling shark's flesh much of which was obviously rotten. The stench was incredible, and I retreated in haste back to the steaming Bazaar.

My visit had been a spur-of-the-moment affair, but now I wanted to stay a while on this picturesque isle. I had no reservations for the Government Rest House, nor could I hope for help from the limited facilities of the English Club or the hospitable Mission. It was my cicerone, Ali, who solved the problem. He would take me to an Arab hotel, he announced, having assumed that I hadn't read the guidebooks which warn against such practice. Beggars can't be choosers, so I shrugged my shoulders and followed my guide's embroidered skullcap into the maze of alleys once again, until he halted at an unprepossessing door. I entered with misgivings, but it actually took a good deal of salesmanship before I secured lodging; finally the proprietor succumbed to the novelty of having an American as a guest.

My heart really sank when a Swahili boy led me up a dark and creaking stairway to my room. It was a sort of cell, whitewashed once upon a time, with a ceiling of poles imbedded in adobe. The rickety iron cot held a thin mattress that was filthy and yellow with age, and the pillow looked, and later felt, as if stuffed with cornstalks. A cockroach the size of a mouse glared at me from a corner, and the windows faced a slatternly Hindu bedroom almost within jumping distance across the squalor of the alley.

With little appetite left, I descended to the ground level for early dinner, passing two naked children asleep on the floor. My fingers were crossed as the host directed me to an alcove in the verdant patio, where I was startled to find a table set with spotless linen and gleaming cutlery—the sugar, creamer, and fruit bowl being antique silver of a quality to bring an avaricious gleam to one's eye.

I was as pleasantly surprised by the meal itself as I had been shocked by the appearance of the bedroom. The first course, a thick soup, was delicious; and when it was whisked away, it was followed by fish so fresh that they must have left their coral reefs that very afternoon. Next the barefoot boy brought roast chicken, tender and succulent, on a silver salver; and when the dessert arrived, it proved to be a flawless custard in a tantalizing sweet syrup. Thick Turkish-style coffee topped off a repast that would have done justice to a holder of the *cordon bleu.*

Warned by my guide of the dangers lurking in the night-shrouded town, I turned in early. Crime is on the increase throughout Africa, and Zanzibar's murky alleys are made to order for assassins well-trained at quick dagger thrusts.

A misty moon was sneaking out from behind a curtain of palms as I crawled gingerly between threadbare sheets, while on the ceiling directly overhead a gecko lizard inspected me sardonically. Outside, the humid night was a cacophony of strident sounds. Urchins and stray dogs fought in the street below, and the caterwauling of a drunk in a near-by bar blended with the bawdy, high-pitched laughter of some dusky demoiselle. Wafted on a vagrant breeze from the native village of Ngambo, the muffled throbbing of drums told of an *ngoma* in progress. As if the bedlam were not sufficient distraction, an extemporaneous peep show, clearly visible through the unshuttered windows, was taking place just across the alley. It was long after midnight when black clouds unzipped in a deluge of torrential proportions to quiet the seething metropolis like a sorcerer's cloak. With the elements drumming a tattoo on the corrugated iron roof, I finally dropped off into a disturbed slumber, my wallet under my pillow and my door double-bolted.

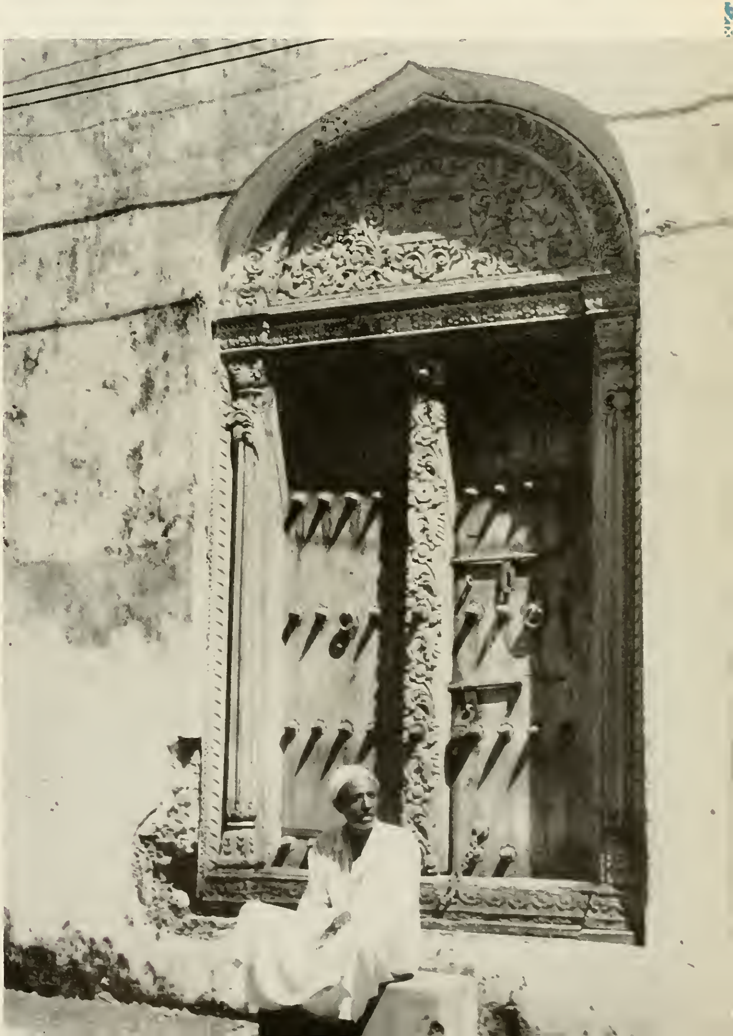
In the morning a blinding sun beat down upon the rain-washed city, and the air was fresh and fragrant with the aroma of spices. My watchdog, Ali, was patiently waiting on the stoop; and after a leisurely breakfast, I set forth to view more wonders of this diadem of old Azania.

Back in the Bazaar the clank-clank of brass cups announced the arrival of the ubiquitous coffee vendor. These enterprising merchants give curb service to Arab customers, who drink the cardamom-flavored Mocha incessantly. A small wooden cart with solid disc wheels scattered the trade as it clattered past. It was drawn by a miniature bullock, whose zebu hump shifted left-right, left-right, in tempo with its trot. It was followed by an Indian on a bicycle, who halted to ring his bell and shout in Gujarati—apparently a local town crier presenting the morning edition of the news.

Ali dragged me reluctantly from the workshops of the silversmiths to show me the Anglican Cathedral, which was purposely located on the exact spot where the old slave mart had been, its altar directly over the site of the whipping post. Above the pulpit is a crucifix carved from wood of the tree at Lake Bangweulu, under which David Livingstone's heart was buried. In that famous missionary's time it was common to see pathetic lines of shackled slaves staggering through the streets, while their captors paced alongside chanting charms and prices in singsong refrain. His descriptions of the horrors of the traffic proved a powerful factor in enlisting world opinion against the slavers, and the boxlike house on Hollis Road, where he lived while on Zanzibar, is visited by most tourists.

Two commodities, slaves and tusks, played a major part in the history of the island. Black and white ivory were so inextricably woven together that no one knows whether the lust for slaves started the ivory trade or vice versa. The enterprising Arabs of Muscat had been inland to every important spot later "discovered" by European explorers, and while some were legitimate merchants who bartered beads and calico for elephants' teeth, these were outnumbered by a more vicious type. The slave raiders ruled with gun, sword, and torch. Their methods included intimidation, pillage, kidnapping, and mass murder. Once their renegade Swahili cutthroats had surrounded and sacked a village, they would massacre old women, infirm men, and young children, taking the attractive girls back for the harems of Zanzibar and drafting the husky males to carry the stolen tusks looted from the chief's hut. When the half-starved prisoners staggered with their burdens to the coast, their reward was the auction block and a life of bondage and abuse. At one time as many as 70,000 slaves were exported per year, and it has been estimated that ten died upcountry for each one that reached the littoral alive.

Slaves who died on Zanzibar were simply thrown onto the beaches to be taken away by the tide or de-



➤ **One of the most typical** objects in Zanzibar Town is the Arab Door, with handsomely carved frame and sharp brass studs. These doors are quite old and were based on ancient Indian palace doors, which were similarly armed with spikes to discourage the attacks of war elephants

◀ A CAT can look at a king, they say, and a mule driver can peek at the Palace of the Sultan in Zanzibar Town

▼ CURB SERVICE in Zanzibar: a coffee seller and his Arab customers, who drink dozens of cups of the cardamom-flavored beverage each day. The clanking of the brass coffee cups announces his arrival

voured by rats, sea gulls, or the packs of half-wild dogs. To ship slaves back to the Muscat homeland, the Arabs packed them sardine-fashion into dhows, squeezing from 200 to 400 onto each vessel. Sanitary conditions were appalling, and in the grim 40-day trip the human merchandise died like flies.

In the old harbor today, dhows still drop anchor. Romantic-looking crafts with lateen sails, they travel 2000 miles on the northeast trade winds, their holds filled with dates, coffee, prayer rugs, and dried shark's flesh for their expatriate kinsmen. From February to April the primitive ships glide into Zanzibar, coming down on the monsoon as they have since the time of Sindbad. At the end of March, the lean brown sailors haul up their plaited grass anchor ropes to make the long voyage home.

Early dhows carried back great cargoes of ivory, for Zanzibar was the clearinghouse for elephant tusks, which were so valuable that they were called "white gold." So ancient was this commerce that in the thirteenth century Marco Polo wrote: "The staple trade of the great and noble island of Zanghibar is elephant's teeth."

From deep in the heart of the Congo, from South Africa, and from far north in Somali country, long lines of sweating porters brought tusks of many sizes and colors. There seemed an insatiable market for "the Pearl of the Forest," and it proved a lure to sportsmen and professional hunters. To the pursuit of elephant for sport or profit came men whose names are now legendary in the annals of big game hunting—Roualeyn Gordon-Cumming, Captain Cornwallis Harris, Charles Baldwin, William Cotton Oswell and later Selous, Finaughty, Sutherland, Neumann, and the greatest of all the elephant slayers, "Karamojo" Bell.

One by-product of the ivory trade was destined to become Zanzibar's most famous son, a black Napoleon of Central Africa called Hamed bin Muhamed bin Juma bin Rajab, better known as Tippu-Tib. This great ivory poacher and slaver was distinguished by elegant dress and a courtly manner, and without his aid the discoveries of Livingstone, Cameron, Stanley, and the German explorer Wissman might never have been accomplished.

In quest of something tangibly connected with ivory and the slave trade, I journeyed with Ali to the Beit-el-Amani, the House of Peace, one of the handsomest museums in Africa. Of modern Saracenic style, it is not far from the center of town, and in it are displayed relics of the sanguine past. There were gold-inlaid muskets and swords, carved war drums of mango wood, and the ancient *Siwa,* sacred horn of Mwenye Mkuu. This mystery man of the Shirazi was as powerful as the Sultan himself, and his crumbling palace at Dunga is reputed to be haunted by the ghosts of victims buried alive in its foundations.

In a glass case in the Beit-el-Amani I found yellowed letters of Livingstone, Sir Richard Burton, John Hanning, Speke, Henry M. Stanley, and other early explorers who outfitted their safaris on the island. Burton, one of the greatest adventurers who ever lived, once recommended that Zanzibar abandon its then embryonic clove industry and plant sugar instead. Were he alive today, he would find that cloves are the mainstay of the Protectorate, which furnishes 80 per cent of the world's supply. Practically anyone who has ever eaten a piece of apple pie or a ham sandwich has bitten into a modest souvenir of old Zanzibar. Much of the export goes to Java, where the spice is used not only in cooking but in smoking. Shredded cloves are blended with tobacco and smoked by many Javanese, who claim that the effect is narcotic and soothing.

The island is not large, being only 53 miles long by 24 wide, and travel outside of town is by bicycle, mule cart, or motor car. There was a sort of Toonerville Trolley narrow-gauge railroad than ran seven miles to Bububu, but that is now defunct. The countryside is tropical in character, and in addition to the clove trees, which grow to a height of 30 to 40 feet, there are coconut palms, banana trees, orange, durian, pipals, mangoes, almond, casuarina, and ilang-ilang. Giant baobabs grow to a tremendous size, sometimes over 70 feet in circumference, and it is claimed that they are so old that no one has ever seen a young tree. In the tilled fields, cassava, millet, sugar cane, Indian corn, sweet potatoes, and eggplant are grown.

Next to agriculture, the most important industry is fishing, and every Swahili is a born sailor. His favorite craft is the *ngalawa*, an outrigger canoe hewn from a mango log, which he takes out in fair weather or foul in quest of fish and turtles. Larger boats manned by many hands are used for trolling for the huge sharks and horse mackerel.

Most numerous inhabitants of the island are the Waswahili, a good-natured tribe who are descendants of early Arab men and black Bantu women. They speak a language called Kiunguja, a type of Swahili heavily interlarded with Arabic. Like their masters, the Waswahili are leisurely, and their slogan, *Kesho inshallah* ("Tomorrow, God willing"), corresponds to the *bado kidogo* of Kenya Colony and the *mañana* of Mexico.

A separate tribe, the Wahadimu, live on the eastern end of the island and claim to be descended from the earliest settlers. They are possibly of Shirazi origin and, unlike some of the coastal people, are kind to their animals and may often be seen leading herds of small Muscat donkeys to the sea for a bath.

The carved teak doors in the town are interesting in the finesse of their execution. When a Zanzibar Arab planned to build a home, he first commissioned a craftsman to carve a beautiful door frame, and the house was then built around the erected lintel. Sometimes the owner's monogram was incorporated in the design; or a stylized lotus might be used as a symbol of reproductive power, or frankincense for wealth, or fish for fertility. The doors are often studded with big brass spikes, patterned after ancient Indian palace doors, which were so armed to prevent their being battered down by the war elephants of their enemies. The present Sultan is considering passing an ordinance requiring landlords to keep the spikes polished. Many shopkeepers hang across their doorway a string of dried mango leaves, a traditional good-luck charm.

The beaches of Zanzibar are white, bordered in many places by low coralline limestone cliffs fashioned into fantastic shapes by erosion. The glamour of the island is enhanced by the fact that on occasion zircons, moonstones, and garnets can be found in the sands of the beaches.

A tropical indolence sets the pace for life in Zanzibar Town, for no Arab likes to be rushed. He is courteous, graceful, leisurely, and by custom eats his food in silence using only the fingers of his right hand. He abstains from alcohol and dotes on sweets, particularly a sticky pink confection called sherbet. Friday is his Holy Day, and the devout pass it in the seclusion of their homes, reading favorite passages from the Koran. Zanzibar was once infamous as a sort of Sodom and Gomorrah of oriental vice, but if this still exists, and it probably does, it is not obvious to the casual tourist.

At midday, tramping the streets is like hiking in a blast furnace, and the humidity is murderous; yet it is probably no worse than a hot August day in St. Louis, Washington, or New York City, and there is a prevailing breeze. Unlike the mainland, it has no tsetse flies and relatively few mosquitoes, although malaria was once taken for granted, and all who lived there for any length of time contracted the "benign" type.

By the time I had to leave, I was quite attached to the place. We took off into a wind heady with the scent of cloves, and soon the mosques and minarets of the fairy-tale capital disappeared beyond our rudder. At the Customs wharf at Dar-es-Salaam a native boat was waiting; and with ebony-skinned Swahilis at the oars and myself at the tiller, we headed for the ship. The oarsmen chanted in unison the whole distance, and when at last I scrambled up the Jacob's ladder, I could hear their song lilting happily across the bay. It drifted faintly through my porthole as I spread out the loot from my invasion of the Never-Never Land of Zanzibar.

➤ THE LATEEN sail of the dhow does not lend itself to tacking, and the boat is unwieldy when becalmed. In consequence, the sailors must tow the vessel into a position where it can catch what slight wind there is. Since these boats are built of teak, a heavy wood, this is quite a chore

Submarine Rockets

Some of the strangest dramas of the deep are enacted by the squids—rebel relatives of the sluggish snails—which have become faster than the swiftest fishes in the sea

By N. J. Berrill
McGill University

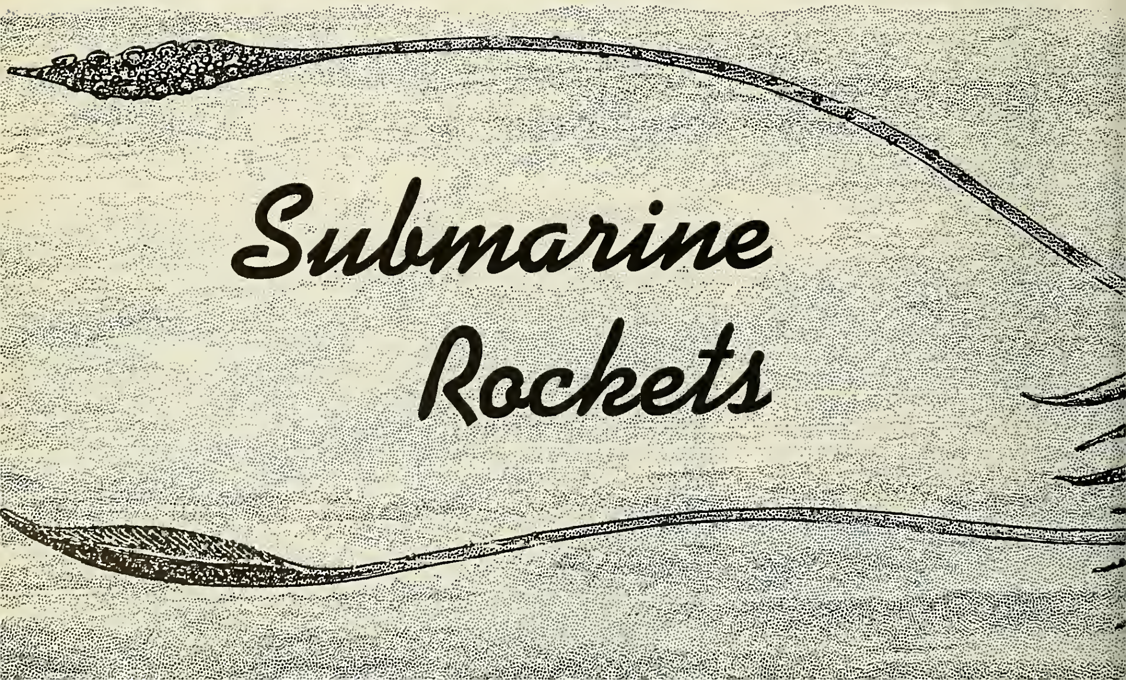
"THIS is the squidiest year I ever twined in" said the Maine fisherman. Off Bailey's Island north of Casco Bay the mackerel seiners had caught 16,000 bushels of squids in their nets in one night. That is an awful lot of squids, and though you can sell some for bait and some for college biology classes, there is little use for squids by the ton. They make a squashed dead weight that breaks nets, and they ooze slime and ink and make a nasty mess generally. The Japanese and certain Mediterranean people eat them, but perhaps the Chinese make the best use of them, drying them for food or piling them up in large vats to wait for the ink to run from the ink sacs. Within the squid there is a translucent shell that is like an old-fashioned pen; ink and pen together are a good reason for the squid's being known as the clerk of the seas.

I had seen squids and squid eggs in aquaria but never in the sea until this year. We were on our way to watch the Memorial Day Parade, and all of us, large and small and all dressed up, took the short cut across the footbridge between east side and the town of Boothbay Harbor. The tide was far out. For a long time now it has been a habit of mine to walk along the edge of rocks, wharves, bridges, or boats to look into the water, as often as not without anything marine in mind. Yet mentally focused or not, my senses respond to anything unusual as sharply as to a silver dollar on a sidewalk.

It was in this way that I nearly missed the parade, and my family would have been more relieved if I had, considering the outcome. In a few feet of water near the bridge was a broad circular band of whitish stuff – something that had not been there a day or two before. It is not always easy to know when a suspicion first arises and when it becomes a certainty, but while I looked and my family went on, the thought of squids came into my mind, and then I saw the shadowy, fleeting figures in the shallows. Squids they were, darting away and then suddenly stopping as they chased and caught small crabs. The white circle was a great mass of squid eggs.

I finally saw the parade in a pair of muddy hip boots, holding an old can containing precious eggs, but I was signaled by my loved ones to stay on the other side of the street and pretend I didn't know them.

The eggs themselves were enough



to show they had been laid within the last day or so, and I went back the next time the tide was low. The great white circle must have been made by dozens of squids, all around the outside of an old tire. Smaller clumps were attached to rocks, but none could be reached in a comfortable manner. It was boots again, wading and sinking in smelly, sucking mud, with water rising about the knees and seeking out the leak in one of the boot tops. None of it mattered much. Most marine biologists seem to have been weaned on mud at some time; they are most at home sliding and slithering and sticking in mud flats. Anyway, the eggs survived the trip back to the aquarium and rock pool that awaited them, and we watched to see if they would hatch.

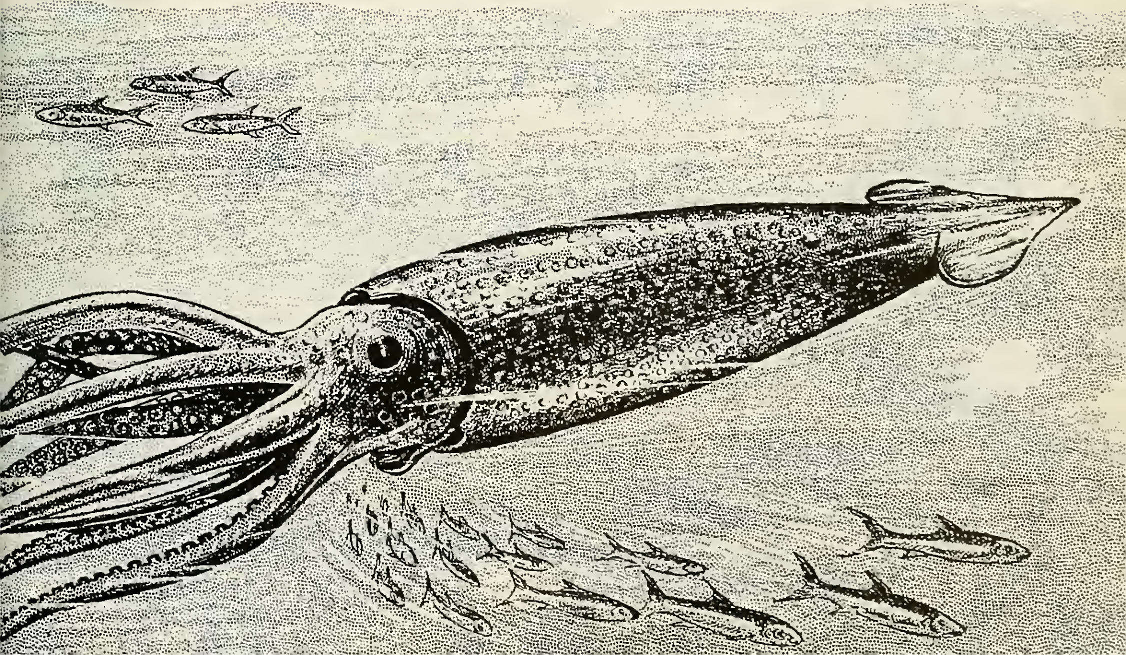
The miracle of the squid is not so much the way it shoots through the water like a living arrow. Rather, it is that squids are mollusks – relatives of the sluggish, heavy-shelled, crawling snails of the sea floor—and yet mollusks that behave in a most unmolluscan manner.

Squids do not swim continuously as fishes sometimes do; but in general they compete with fishes on the fishes' own level. Of the two, size for size, the squids are by far the faster swimmers, and salvage divers swear they are the more intelligent. At the other extreme of their phylum, or tribe, are the equally molluscan oysters, without a head, without power to shift their position a fraction of an inch, forever straining the water that lies within reach for the particles of food it may hold. Both are mollusks, each with a shell, a molluscan heart and gills, muscles and nerves on the molluscan plan, and a system of intake and output of water.

An oyster sits permanently on the spot where it first landed. It has no need to see where it is, for it's going nowhere, and it goes in for thicker and harder shells, wherein lies its safety. In the life of its relative the squid, everything is different. The squid never rests on the sea floor and has lost the lime in its shell in order to lighten the load. It has the streamlined shape of a rocket, for speed is its specialty. And it has a head with all the equipment needed for oceanic navigation and the hunting of prey.

It can do everything a fish can do, but it does it in its own way, with its own unique equipment. It is streamlined for speeding backward, not forward like a fish, and is reminiscent of that mythical backward-flying bird that doesn't care where it's going but would like to see where it has been. It can also swim slowly forward by undulating a pair of fins. But where the fish sculls with a driving thrust of muscle and blade against water, the squid draws water quickly in through the wide mantle opening and then sends it like the jet of a rocket out through the funnel. Some fishes use the water from their gills to aid them in swimming, but the squid is Nature's rocket par excellence.

Its motion is true jet-propulsion. Water is the agency; the bands of muscles encircling the body and the water chamber within supply the power. And none of it was originally designed for travel, for the whole mechanism is, in its basic make-up, the respiratory gill system that all mollusks have. The gills are still there in the squid, lying like feathers in the watery mantle chamber. And because the animal



is a high-speed, energy-consuming living rocket, it needs more oxygen than the oyster, not less. So the gills that collect the oxygen, the blood that carries it, and the heart that pumps the blood are even more efficient. The fish manages to work with one heart to pump its blood through gills and body. The squid does better—one heart for the body and one for each gill, so that the gills run on a supercharge. Rocket-shaped, jet-propelled, with special fuel pumps—it's no wonder speed has been developed.

Yet speed has little value by itself and by itself permits an animal neither to capture nor to escape capture. So we come to that amazing organ, the head of a squid (or an octopus, for they amount to much the same thing). The head is a head-and-hand rolled into one.

Think for a moment about where squids have to operate. Most of the time they prey upon fishes, often far from shore and usually a long way above the floor of the sea. To stay within proper physical bounds it is necessary for them to detect whether they are moving toward the surface or toward the sea bottom. So eyes, of a kind, and gravity organs are both necessary and present. Their gravity organs are simple—little more than sacs with weights in them. Squids, like most animals, have a pair of them buried within the squid brain itself.

Apart from these organs of sight and balance, and the brain within, the head of the squid is a circle of a few long whiplike tentacles, each with its double row of vacuum-suckers to hold with, and a formidable beak at the center where the mouth lies.

* * *

I went down to the pool into which I had transplanted the eggs. Most of them had turned white and opaque and were obviously no longer alive. It was almost as though they were hard-boiled. This was puzzling, for the water was continually freshened by the tide, and certainly it was cold enough. A few eggs, embryos by now, seemed about ready to hatch. But even these died before they succeeded, and it was more than time to go back and see what had happened to the eggs at the bridge.

This time the tide was a little lower, for the full moon had just passed its prime, and I found the eggs without getting a boot full of cold water. The large mass I had first seen was gone, all hatched and gone on their way, but some fresh egg masses had been laid more recently. Two or three reddish-brown squids shot away quickly out of sight.

An old lobsterman in a small skiff pulled over, for a fisherman is as curious as any boy. He asked what I was doing. Any marine naturalist knows well enough to expect almost any question or comment, for as a rule he is caught doing something peculiarly silly in some place where every fisherman knows there are no fish. And when you are told, "You can't catch fish there," or "Shrimp is over there," it seems either rude or imbecilic merely to wave, smile weakly, and go right on with what you are doing. You do get hardened to it, as I suppose a painter gets used to a crowd of kibitzers.

"What have you there?"

"Squid eggs."

The old man was at once eager to see them. I was a little surprised he had never seen squid eggs before; but after all, this really was the squidiest year, and probably I was in more luck finding them than I realized. He looked at the eggs and looked at the water. The tide was dead low, and I could just manage to wade to the eggs without boots.

"It's fitting, isn't it?"

I asked him what he meant. He looked again at the tide. The eggs are safer close inshore, he said, but how do the squids know enough to lay them where the tide won't leave them high and dry, right at the very edge? The only answer I could think of was that the squids might wait for low tide and then lay their eggs as close to shore as possible. It could be true. And, he went on, everything in the living world but man seemed to fit; it all made a pattern, though he couldn't see what the pattern meant.

The near-by boulders beneath the surface of the water were festooned with the eggs—with hundreds of cigar-shaped masses of jelly, each about the width of a pencil, each small mass containing 50 to 60 developing eggs. I took as many as I thought I needed and put some again in the pool, the rest in the aquarium. This time there were eggs at almost every stage of development, and at least I wouldn't have to wait for weeks for some of them to hatch. The embryos were held secure in the fingers of jelly, though each one had its own small compartment in which to become a squid. Each egg, in fact, lay within a small spherical capsule filled with fluid, and it was these capsules that the jelly actually held together.

Few people have ever seen squids either mating or depositing their egg masses, and I doubt if there has been anyone who has seen both activities. It is a rather complicated business, not so much because the sexes are separate and are not combined in the same individual as in many snails, and only partly because the eggs must be fertilized before they get all wrapped up in jelly. These are factors, of course, but it is the combination of these with the free-swimming life of the animals in the open ocean that makes things rather difficult. Most of the whole pointed end of a female squid is set aside for the production and ripening of eggs. The jelly is added to them as they are passed out of the oviduct into the gill chamber, just before they are deposited. And to develop they must be fertilized on the way. That means sperm must be there in the right place at the right moment. So we come to the male animal.

Squids of both sexes have ten arms. Eight of them are moderately long and correspond to the eight arms or tentacles of an octopus. The other two are much longer and are used more like hands in the actual capturing of animals for food, as distinct from holding them. Now, it would do no good for sperm to be shed freely in the water. It has to be ready for use in the mantle or gill chamber of the female when her eggs are ready. Even if the water carried sperm into the chamber, the chances would be remote for the eggs to be fertilized. What happens is this. The microscopic sperm cells are made up into small pencil-shaped packages called spermatophores, each about a half inch long, in a special gland possessed by the male. As these packages accumulate, the male inserts one of his two long arms down into his own gill chamber, grabs a handful of sperm packets, swims alongside a female, and shoves the collection into her mantle chamber. Or he may deposit them in a special pit beneath the mouth in a membrane that surrounds the mouth. Later, perhaps very much later, when the eggs are ready to be laid, each packet explodes inside the female, to liberate a cloud of sperm cells, which fertilize the emerging eggs. By this time, of course, the independent male may be several hundred miles away chasing a fish or a crab.

The eggs in the pool began to turn opaque and white again, like the first lot. It didn't matter very much, for the rest in the aquarium seemed to be healthy enough and doing their best to develop a head and a heart. But it was puzzling, until I remembered something I suppose I had known all along. It wasn't a matter of temperature or oxygen. Embryos lived happily for hours and even a day or two in a little more than a drop of sea water on a glass microscope slide with a glass cover. If they had been sensitive, they would either have been asphyxiated or had a heat stroke. It wasn't the temperature of the pool that coagulated the eggs, or the heat from the sun. It was the light of the sky itself, north light if you like. And not the light you see. A simple check showed this, for a sheet of glass placed between the eggs and the surface of the water put a stop to the cooking process.

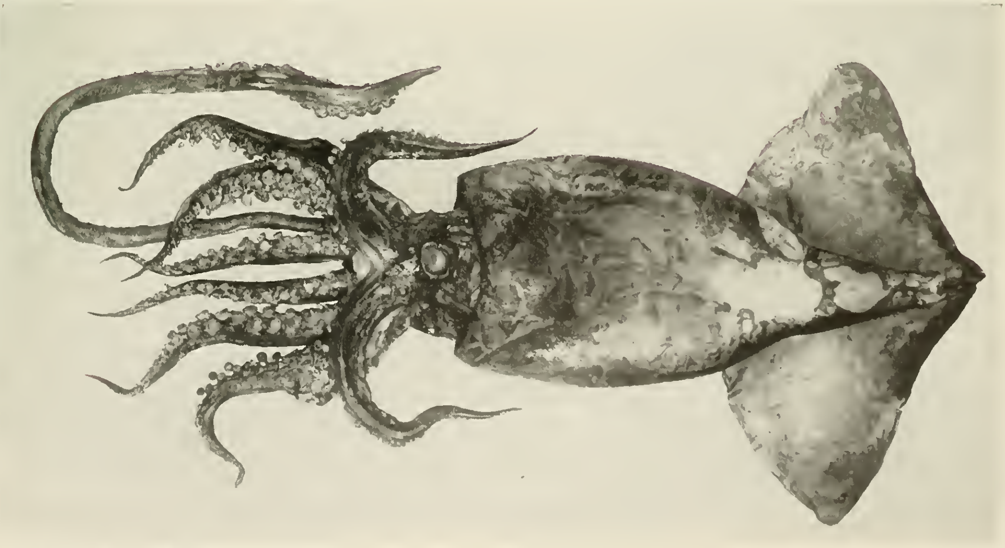
The difference between the eggs in my pool and the ones I had left where I found them was in the amount of water that covered them. Even at low water there was several times as much water overlying the spot chosen by the squids in my pool. And most of the time it was very many times more.

You do not get a sunburn because the sun's rays are warm. Neither do you get it from the white light you see. In fact, you can get as good a burn as any in a nice, thick sea fog. The light that burns is invisible, though a bee can see it; it is the ultraviolet light, which lies just beyond the blue end of the spectrum. This is the so-called black light, and there is a long and important story behind it, for it has entered into the original creation of life on this planet. It is potent, dangerous light, and living things need to protect themselves from it. On land they guard themselves with pigment—skin coloring. In the sea they stay away from the surface. What I had done was to bring the eggs too close to the ultraviolet light pouring in from the heavens. Glass stops it, and that was all they needed. Even the intense light from my microscopic lamp did them no harm, in spite of its powerful condenser, for there was glass between them and the invisible death rays.

At first I could see little in the egg. Then after a few days a thick film spread over the egg from one of its ends and slowly formed a sac of tissue around the yolk. And as this went on, the first end began to thicken, and gradually I saw an embryo taking form—a small round

THE SQUID has a tubular body and ten arms that trail behind when it rockets its way through the water

AMNH photo



body and head. Long before very much of the yolk was used up, the colorless embryonic eyes grew out as striking objects. The microscopic heart could be seen beating within the body, and the ten tentacles were reaching along the sides of the sac of yolk.

Long before the embryo has power to act, the whole egg in which it grows starts to glide and turn slowly about in its liquid spherical prison, with the seemingly effortless ease of a dirigible. As a matter of fact, you can see the same thing happen early in the development of a frog's egg. In both instances, the outer layer of the developing egg acquires a virtually invisible coat of fast-beating hairs that cause it to turn and slide through the liquid surrounding it. The movement seems to be important in bringing sufficient oxygen to the surfaces of the embryo.

After a while the embryo begins to grow quickly, and the yolk is used up just as fast. Then for a time the growing embryo seems to be holding its yolk sac to its mouth with its arms, for all the world like a baby with a feeding bottle. Finally, when the unborn squid has become a little cramped, it takes to the habit of holding onto the walls of its capsule with its fins. The bottle of yolk is just about disappearing into its mouth, and the little creature has developed gleaming colors, when the prison walls soften and break—and the youngster swims out.

I doubt if there is anything more entrancing and more beautiful than a newly-hatched squid. This sounds hard to believe, but everyone who has seen one has had the same feeling. It is tiny, dartingly active, almost all eyes, but above all it is covered with innumerable small patches of color—red, yellow, green, black—not in a set pattern but each flashing, large and small, to make the creature a scintillating jewel of tiny life. My baby squids were only one-eighth of an inch long when they hatched, and when I set them adrift in the sea, I certainly wished I could follow them on their adventures.

A DESERT WALKING STICK

Now you see it, now you don't—as Nature's living twig defies the sharpest eye

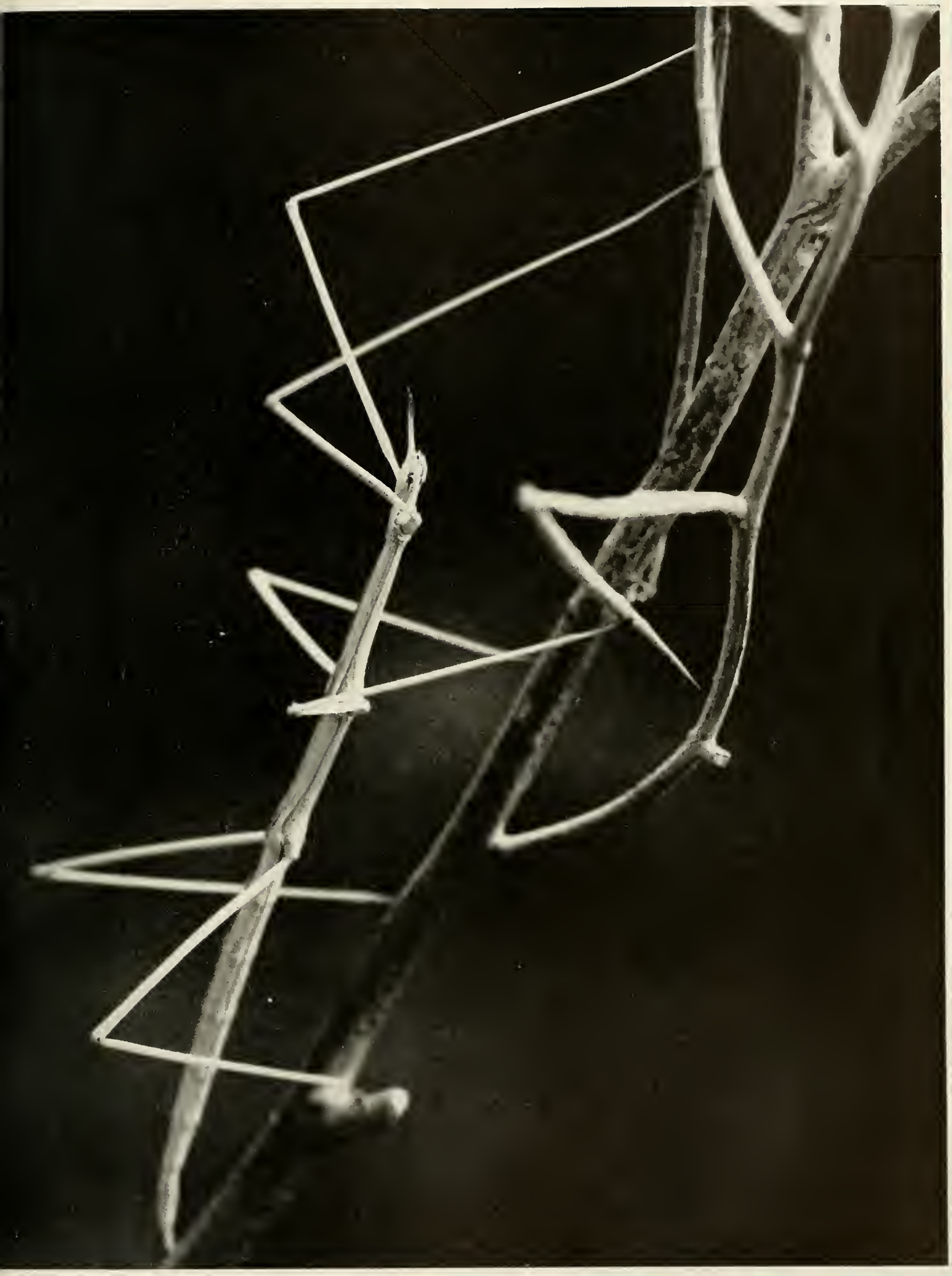
By Lewis Wayne Walker

WE were in Lower California's Viscaino Desert when we saw this insect, on the road between the Onyx Quarry at El Marmol and Bahia de Los Angeles on the Gulf of California. We were having to disconnect the moving parts of the front wheel differential, and night had settled before our work was completed. From all about us, there was a cacophony of sound as myriads of unseen insects tuned up for their evening chorus. Some of the more phototropic were drawn as though magnetized toward the rays of our Coleman lamp. But the thing that caught my eye was a twig walking across the blackened sands beneath the car. While in motion, we could see that it was alive; but in repose, it could have been a bit of straw dropped by the desert winds. As we watched, the horizontal matchlike body crouched low to the oil-stained surface, then lifted itself about an inch above the ground and, with stately, measured tread, walked away. Upon the oily ground, this desert walking stick was a conspicuous white on black, but the moment it reached normal sand, it simply melted away. It became so nearly invisible that we could hardly follow its course to a silvery-gray smoke tree.

As this living twig cruised about the angular thorns and branches, it became with each motionless stop just another bit of the plant swaying with the breeze. It was a perfect example of protective coloration and form, from its angular legs, replaceable if damaged, to its thicker body, which matched the heavier limbs. A single tap on a twig—our imitation of a bird alighting—brought about a complete and instant rigidity, which made the walking stick and the smoke tree one and the same thing.

➤ WHERE DOES the twig end and walking stick begin? The creature i well camouflaged that in nature you look squarely at it without seein

Photo by Lewis Wayne Walker



A DESERT WALKING STICK

Let's Make the Desert Yield

In a hungry, crowded world, the vast and silent deserts have mocked man's efforts to expand his horizons. But the lessons of primitive people reveal that these areas may be an important source of agricultural wealth

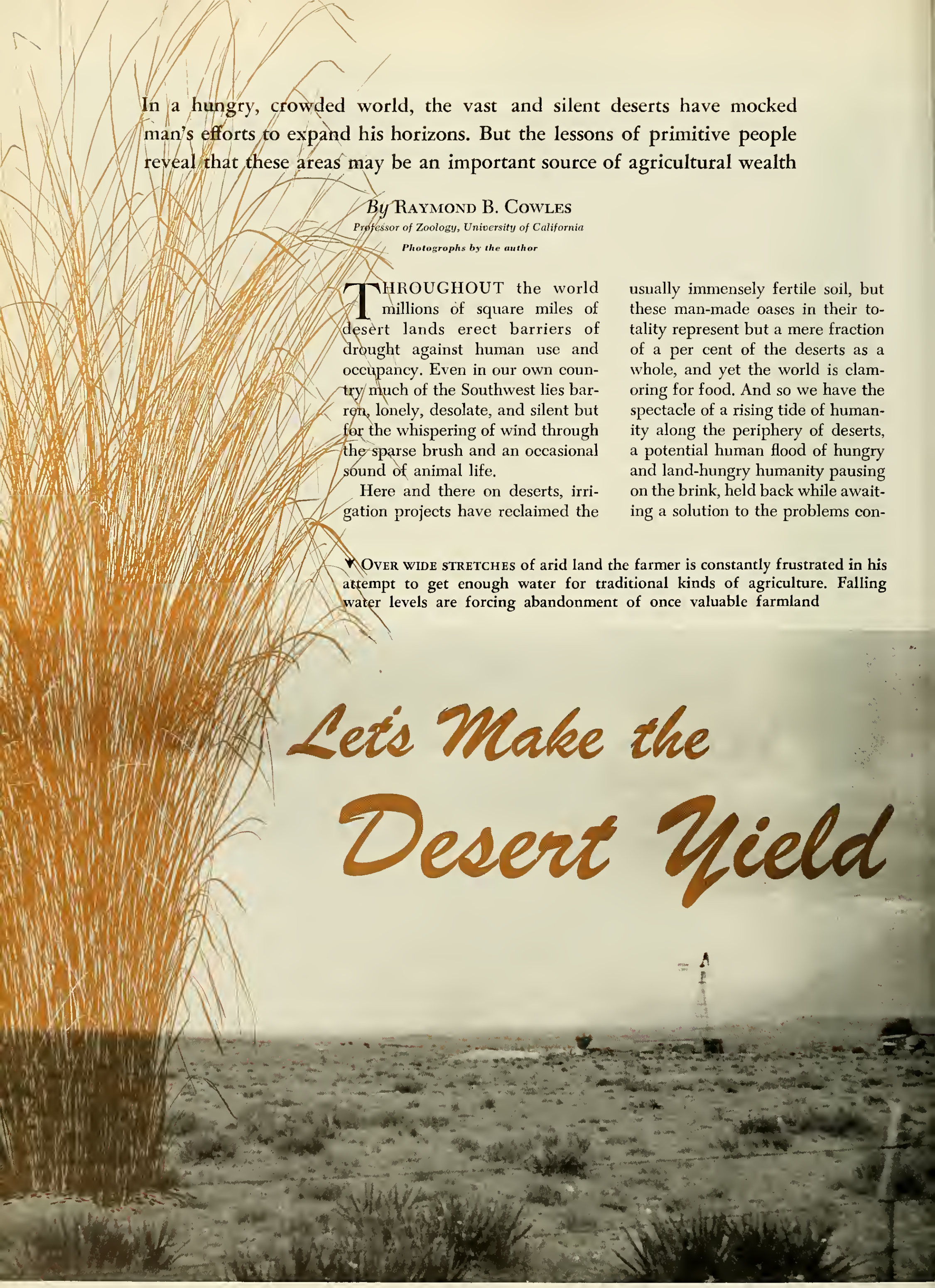
By Raymond B. Cowles

Professor of Zoology, University of California

Photographs by the author

THROUGHOUT the world millions of square miles of desert lands erect barriers of drought against human use and occupancy. Even in our own country much of the Southwest lies barren, lonely, desolate, and silent but for the whispering of wind through the sparse brush and an occasional sound of animal life.

Here and there on deserts, irrigation projects have reclaimed the usually immensely fertile soil, but these man-made oases in their totality represent but a mere fraction of a per cent of the deserts as a whole, and yet the world is clamoring for food. And so we have the spectacle of a rising tide of humanity along the periphery of deserts, a potential human flood of hungry and land-hungry humanity pausing on the brink, held back while awaiting a solution to the problems con-

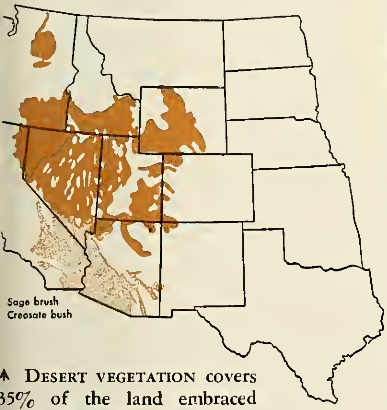


▼ OVER WIDE STRETCHES of arid land the farmer is constantly frustrated in his attempt to get enough water for traditional kinds of agriculture. Falling water levels are forcing abandonment of once valuable farmland fronting it. Expansion of irrigation from underground water resources is approaching an end; in fact, in many areas falling water levels are forcing abandonment of farming, and for most areas irrigation can be had only at enormous, probably economically impractical, costs.

For the past century, expanding populations have forced man to farm progressively more marginal land, to creep upward onto less fertile hill slopes and into semidry prairies. Elsewhere swamps have been drained and rivers have been banked and channeled to permit farming. Almost all lands of high agricultural worth have already been put to use. Only along the desert edges has the human tide been checked by the terrible aridity.

▲ Over thousands of square miles of desert, there is enough rainfall to support considerable native plant growth. Among them are scattered edible species or others endowed with strong flavor, pungent oils, and possibly medicinal ingredients

After U. S. Dept. of Agric. Misc. Publ. 670



▲ Desert vegetation covers 35% of the land embraced by eight western states—an area more than four times the size of New England

Because of the drastic need for more food and more room, these vast desert areas confront us with a very real challenge.

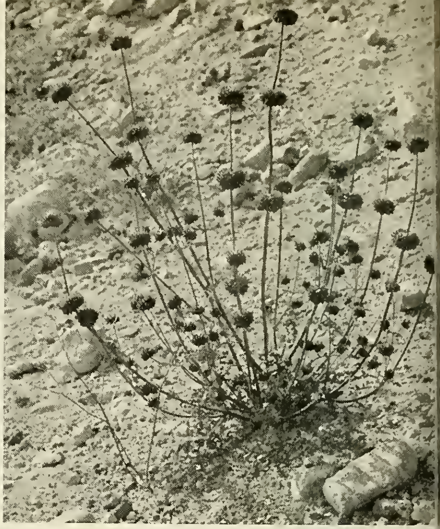
We are impelled to search for ways of putting them to use; yet present conventional methods and thinking are making no progress. Only a totally new approach can devise the means for the general utilization of desert lands. Irrigation and artificial rain-making can never provide enough water for a widespread agriculture employing the crops with which we are familiar.

Therefore, in order to put these wastelands to widespread use it will be necessary to discover new crop plants—plants already adapted by nature to the drying winds, burning sun, and infrequent rainfall. There are many such plants, and it seems reasonable to expect that at least some of them might prove to be valuable assets in desert areas. Only by widespread exploration will they be found; and following their discovery, experimentation must be conducted in order to determine their economic utility.

Although their discovery might at first appear to be difficult, there is already a great body of information that can expedite the search—the experience of native peoples who have dwelt in the deserts around the world. In all of the world's arid regions there are people whose whole economy—food, clothing, even drugs—has come from native plants and animals. But for the most part these people have not practiced agriculture, except in the loosest sense of the word. Therefore, they have not systematically developed the especially valuable strains. Nor have desert plants been adopted into the agriculture of more advanced cultures, with extremely rare exceptions.

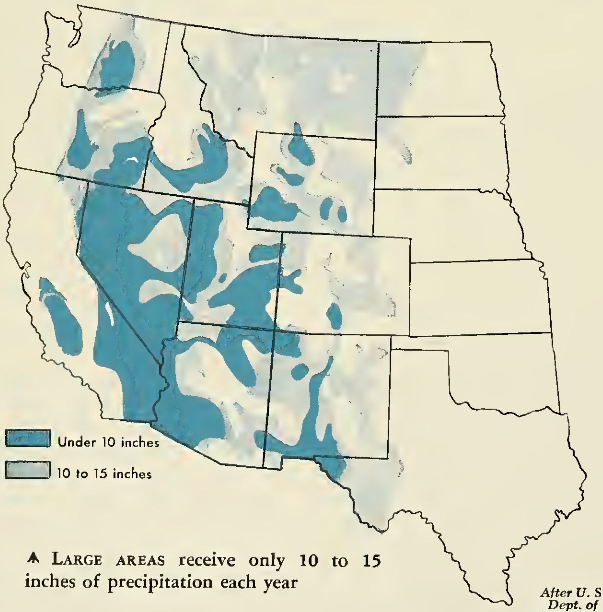
In our own deserts the ethnobotanical records indicate that there are scores of food-producing plants that in the wild, unimproved state supported populations of many thousands of Indians. Among these hitherto unexplored resources alone there may be many types of plants suitable for a real desert agriculture. If to these are added other species used by natives of other deserts, we should have hundreds of plants from which to choose those best suited to our

▲ PERENNIAL BUNCH GRASSES produce heavy crops of edible seeds and are important to the stock grower. Selected varieties, grown in pure stands, might reclaim many desert areas



▲ THE SEEDS OF CHIA, a desert-loving mint, are nutritious and delightfully flavored. In pure stands they could be harvested by machinery

needs. To the natural question as to whether or not systematic studies, including plant introduction, genetic and crop production research would be justified, the answer is an emphatic yes! Among the truly desert crops, there are bound to be many suitable for growth in marginal lands having greater rainfall, though not enough to support regular kinds of agriculture. There are great areas of these marginal lands that now support only a precarious agriculture. Throughout these regions the vain hope prevails that the rainfall in any given year will be above average and thus produce crops that will recoup the losses from previous years of drought. Although economic conditions frequently stimulate farming, the soil itself usually suffers, and the net result is of dubious value. It is entirely possible that the cultivation of drought-loving plants in these areas would reverse the usual crop failures during dry spells and substitute crop success *except* during years of exceptional rainfall!



▲ LARGE AREAS receive only 10 to 15 inches of precipitation each year

After U. S. Dept. of Agric. Misc. Publ. 670

Among the many useful or interesting plants already known to exist in our deserts can be mentioned a few samples, such as the native tobaccos, which have a delicate fragrance suggestive of Turkish varieties. On hundreds of thousands of acres there are the bunch grasses, so useful to the stock raiser. Among them are species known as dropseed, which are perennial and frequently produce crops of small grains that weigh down their heads. These were used for food by the Indians and might again come into use. Of especially great interest is the chia. This is a mint that grows under a very wide variety of conditions, possibly because it was unintentionally distributed by the Indians, who rated it as a staple article of diet. The seeds were used in cakes, as a flavoring ingredient, as a "mush" (because of an interesting mucilaginous property), and

▲ THE JOJOBA, or goat nut—one of the most promising of our desert plants. Its nut contains 50 per cent of an oily wax of high quality. It is useful as food and in a variety of products from candles to printer's ink

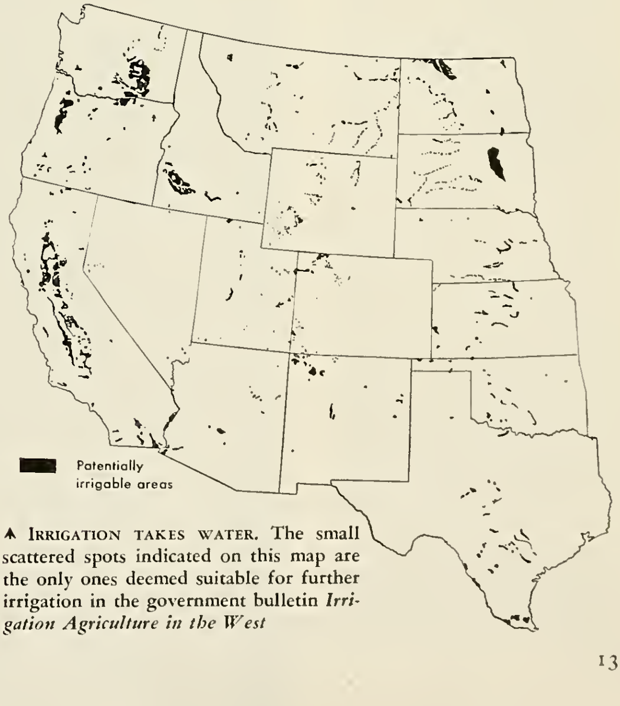
also for the production of a refreshing beverage. It is highly nutritious and should be easy to harvest with regular grain-harvesting machinery. In addition to these items there are plants that produce beautiful natural dyes; others yield strong fibers, aromatic oils in great profusion and variety, and vegetable fats and waxes that rival sperm oil in their characteristics. There are an unknown number that produce insecticides, insect repellents, rodenticides or repellents, antioxidents, antigerminants, possible weed killers, and many very interesting toxins and drugs that might prove valuable in the treatment of human disease.

Because these native plants already proffer so much of interest and potential value, and because we can expect to double or triple the number of useful desert plants by means of exploration and the introduction of foreign kinds, the prospects for developing a genuine agriculture seem thoroughly assured. When we consider the almost magical results already achieved through genetic studies and selective breeding, it seems surprising that we have not yet created specific foundations for the study and development of a true desert agriculture. The guideposts leading to the most promising plants have long since been seen and understood by a small number of ethnobotanists, but on the whole the opportunities have been ignored.

There is a natural tendency to disregard or reject the discoveries of more primitive cultures. This has been particularly evident with respect to medicinal plants, although of recent years there have been numerous instances in which, in spite of earlier disappointments leading to skepticism, some of the plants known to herbalists of old have been reinvestigated and resurrected for present use.

Some centuries ago a Chinese herb doctor discovered that extracts from a beautiful feathery-leaved plant alleviated the symptoms of certain types of allergies. Only comparatively recently this drug, ephedrine, from the scorned pharmacopoeia of an oriental herbalist, was adopted into our own medical practice. Much later, another herbalist in England was reported to have a drug that performed miracles in the treatment of certain heart diseases. Today that drug, digitalis, is still saving the lives of millions of heart sufferers even though the exact manner in which it produces the desired results is scarcely understood.

About the time that some of the early medicinal herbs were being used in primitive fashion, the Indians of our own continent were experimenting and selecting native



▲ IRRIGATION TAKES WATER. The small scattered spots indicated on this map are the only ones deemed suitable for further irrigation in the government bulletin *Irrigation Agriculture in the West* remedies. Among these is one that has only recently come under scientific experimentation. Long ago, the Indians in some parts of our West were using an herb that seemed to have an effect in regulating conceptions so that there could be some timing in the births of their infants. Today this plant, *Lithospermum ruderale,* is being studied by biologists and pharmacologists in order to discover whether or not the Indians really had a drug plant usable for this purpose. It seems probable that there actually is an active principle as reported, but there is still some argument as to whether it works through the master gland, the pituitary, or directly on the reproductive organs themselves.

Every race has, or has had, its pet native remedies. Most of them will probably prove to be disappointing, and all will have to pass careful tests. But the discovery of even one drug as unique as digitalis would be sufficiently rewarding to justify the tedious and expensive procedures required for its development. There is reason to believe that, like other peoples of the world, our own Indians used many effective plant drugs. In their religious ceremonies they used tobacco, a plant discovery that has been worth many millions of dollars in the trade of the world, and they also used Jimson weed, *Datura,* a plant allied to the one from which we extract atropine. They also employed several members of the aster family, one of which apparently contains a nerve stimulant sufficiently potent to cause nerve tremors when smoked to excess. Among the closely related sagebrushes, the Indians also had favorite medicinals that served them as insecticides, balms, hair tonics, cathartics (both mild and vigorous), febrifuges, and even headache remedies. The ornamental milkweeds served similar purposes; and since many of these plants are poisonous, it is not surprising that the Indians put them to use, nor will it be surprising if modern science finds some to have real value. It was from primitive cultures that we lifted some of our time-honored drugs—castor oil, cascara, croton, and others, quinine from cinchona bark, curare and digitalis, opium and ephedrine, and a long list of other valuable substances. All of these were originally discovered by accident, by primitive people. Could scientific methods proffer hope of making equally valuable discoveries? Certainly it would be preposterous to assume that all has already been discovered.

It will not be necessary now to pursue the dreary trial and error methods that our primitive ancestors followed, often at considerable peril, to benefit from our plants. Future developments might follow a pattern suggested by more recent discoveries of the so-called miracle drugs from the lowliest of plants, penicillin, streptomycin, bacitracin, terramycin, subtilin, and aureomycin. Equally interesting is the discovery of animal-like substances such as cortin and ACTH in *Strophanthus* or in yams, the female sex hormone in pussy willows, and the fungus ergot.

The pathway to new discoveries may be shortened by turning our attention to the deserts where so many plants must possess protection from a multitude of enemies. Wherever food supplies are scarce, particularly as in desert areas, every source of sustenance becomes a target for all the local creatures. Plants that are to survive must therefore have protection from the animals capable of using them as food. Those that survive best are those endowed with the best protective devices. Abundant thorns, spines, and hairs are among the most obvious of these devices, but equally numerous are vile or bitter flavors, pungent oils (apparently many of these are highly volatile), and many other types of repellent properties. It should be chiefly among the thornless—that is, in those having the more subtle defenses—that

➤ The luxuriant foliage of the Coyote Melon, or Wild Gourd, can be seen in many dry, inhospitable wastelands of the Southwest

➤ WHEN IN BLOOM, the Joshua tree presents a beautiful spectacle and promises better grazing for the stockman

➤ THE JOSHUA TREE's heavy blossoms are creamy white and exude a fragrance reminiscent of fresh mushrooms. The desert Indians used the buds as food

the most interesting discoveries should be expected. These species might be expected to wage their defensive wars by chemical means.

Millions of dollars have been spent in the search for useful foreign plants and in their introduction. Many of these new plants have been introduced from tropical and subtropical climates and would therefore be unsuited for cultivation over much of the United States. Other millions have been well spent in the genetic improvement of wild crop plants such as cranberries and blueberries and in the development of new varieties of plants already having a long history of cultivation. In contrast to this, there is a remarkable absence of experimentation with plants that grow practically in our back yard. These plants already are adapted to the rigors of life in regions that have not been utilized. This almost total absence of a systematic search for the hidden wealth of our own deserts is a surprising revelation of shortsightedness and preoccupation with conventional procedures. The day is not far distant when we may need to use all of our natural resources to their utmost. In most of the world there is already a dire need for more resources. It would seem advisable to get an early start on the problems of true desert agriculture and thus anticipate our future needs.

We have already noted how often desert plants have strong odors or essential oils. Just how many of these are of potential value and are now going to waste while we import others, cannot be known until additional investigations have been carried out. But we do know that there are vast numbers of fragrant plants that owe their pungency to volatile oils in stems and leaves. Some of these plants are so heavily charged with oils that merely brushing against them leaves the clothing redolent with their odors. One of these, *Thamnosma,* like many others, is so supercharged with oily glands that crushing the stem releases a large quantity of strong-smelling substances. Among the numerous members of the mint family there may be plants that could produce flavors useful in perfumes or as additives in medicines and liniments or in dentifrices. In addition, it may be remembered that according to Indian beliefs some of these plants had analgesic, anodyne, and other valuable characteristics.

That the deserts and semideserts of the world are capable of producing useful food plants has already been shown by the successful introduction of some interesting ones, which may come to be as fully appreciated here as in their native lands. Not many have been introduced, but there are enough to suggest that more thought should be devoted to the development of our own food-plant resources. From the Mediterranean region we have introduced the locust—St.-John's-bread, or Carob—and it is widely grown in Southern California. It is now used only as a shade and ornamental tree, in spite of the fact that when it is mature it is known to produce one of the highest food yields per acre of any plant known. The nutritious and tasty pods furnish an abundance of good food for both man and his grazing and browsing animals.

The almost complete neglect of another plant, a North African desert tree known as *Argania,* is surprising, because it is potentially exceedingly valuable. This tree, which reaches a height of 40 feet with a trunk as much as 18 inches in diameter, produces an abundant crop of olive-sized fruits containing a high percentage of edible oil. Because of the great need for good vegetable oils, it is surprising that only the olive tree has been adopted extensively in this country.

It is just as surprising to learn that one of our own plants, a native of our semidesert areas, has been equally neglected. This is the jojoba, the goat or sheep nut, which is scarcely known beyond a very small group of botanists and chemists. The fruit of the jojoba is a nut about the size and shape of a hazelnut but with the advantage that it requires no shelling. It is relished by both man and his animals, and the foliage provides excellent browse for livestock. Because of this double value, this plant should be thoroughly investigated. It is hardy and drought-resistant, and it grows wild in an enormous area extending from the western parts of Texas and the Del Rio country, westward into California, and southward into Mexico. Even as it exists now, with no improvement, it might be an exceedingly useful addition to the agricultural plants of other areas where the native populations suffer from water shortages and also need to supplement their diet. The plant is attractive in appearance, with a grayish-green foliage and inconspicuous blossoms; and because of its hardiness and food-producing capacity, it might flourish in some of the soil-depleted areas around the Mediterranean, possibly in Greece. And because of its usefulness and beauty as a boundary plant or hedge, its testing might be undertaken rather easily.

The jojoba nut contains almost 50 per cent of an oily wax. In ancient times this was used as a food, a hairdressing with supposedly tonic properties, and an eyebrow restorer, and it is now known that after extraction of the oily wax, the residue from the nuts makes a good stock feed.

The liquid wax has evoked so much interest that several fairly extensive studies have been undertaken. These have led to the discovery of several products such as hydrogenated wax, which makes excellent candles with a high melting point—a most useful characteristic in hot climates. More recently it has been discovered that the oil has antioxidant properties that might make it useful as a shortening in place of, or mixed with, other fats that tend to become rancid. It is of considerable interest to note that another desert plant, one of the most widely distributed of all, the creosote bush, *Larrea*, also produces an antioxidant. It may be that desert plants in general will show this characteristic, a possibility that is worth investigating.

The jojoba liquid wax is useful in printer's ink, and when purified, it serves as a lubricant for delicate instruments. It can also be used as a substitute for carnauba wax, with which it ranks in hardness and utility. It has even been suggested as a substitute for coffee, although this expedient of the old-timers is not recommended unless coffee even exceeds its recent fantastic price level. All in all, this valuable resource, common to California, Arizona, and Mexico, has been little used. Because of its surprisingly versatile uses even in its unimproved natural-growing condition, it is certainly worthy of thorough study.

Experimental plantings and initial experiments on the jojoba by commercial concerns have unfortunately been terminated. A possible explanation is the slow growth of this plant and uncertainties as to the ultimate cost of production, including labor costs. This is an excellent demonstration of the need for co-operative ventures where very long-term experiments are necessary and of the value of private, state, or even federal co-operative research.

Another plant that might prove to have great value in desert agriculture is the desert wild gourd, or coyote mellon. It is reported that the Indians used the seeds of this and related species of gourds as food and a source of oil. When raw, the seeds are exceedingly bitter, but the Indians may have known how to eliminate this characteristic. It has recently been reported that seed production from naturally growing plants may reach from 700 to as high as 3000 pounds per acre, with oil and protein content around 34 per cent each. From an interesting technical report on these gourds it appears possible that even on unirrigated and now barren desert lands it might be possible to produce oil in quantities rivaling the peanut and soybean under good conditions.

Altogether the food plants that might be grown in desert and semidesert country make an imposing list of excellent prospects for experimentation, and the list includes a number of foods that seem delectable even to the beginner. Among these are wild onions, the starchy bulbs of the Mariposa lily, the brodias, and the camass. These and many more are nutritious and easily prepared. Another group of plants not distantly related to the lilies are the agaves and their relatives, including the yuccas and the grotesque Joshua trees. There are several species that are useful as human food and also valuable as stock food. Less well known is the fact that the seeds of the Joshua tree and other yuccas contain good quantities of vegetable oils that might become of value as an article of diet.

Wonders have been accomplished in producing giant blueberries, huckleberries, and other fruits with heightened flavor, production, and hardiness. Modern agriculture depends upon the genetic studies that have produced improvements of this sort. There is little reason to doubt, therefore, that with selection and breeding, similar miraculous results can be achieved with the wild plants capable of growing on some of the greatest areas of waste space now confronting man on this rapidly overpopulating world.

The discovery of even one native desert species of plant that would make cultivation of the desert a profitable venture would pay enormous dividends on the necessary investment in research.

Photo by U. S. Army Signal Corps

Carrier Pigeons

IN THE POLAR REGIONS

The bird that has won battles and carried the mail proves itself equal to new hazards in rescuing stranded polar explorers

By Malcolm Davis

National Zoological Park

WITH the increasing military importance of the polar regions, dependable methods of communication between reconnaissance parties and a home base or ship become more and more vital. Suppose a party is out on the polar ice. A storm comes up; the party becomes bewildered and loses its way. Then something goes wrong with the radio equipment. What can be done in this anxious moment?

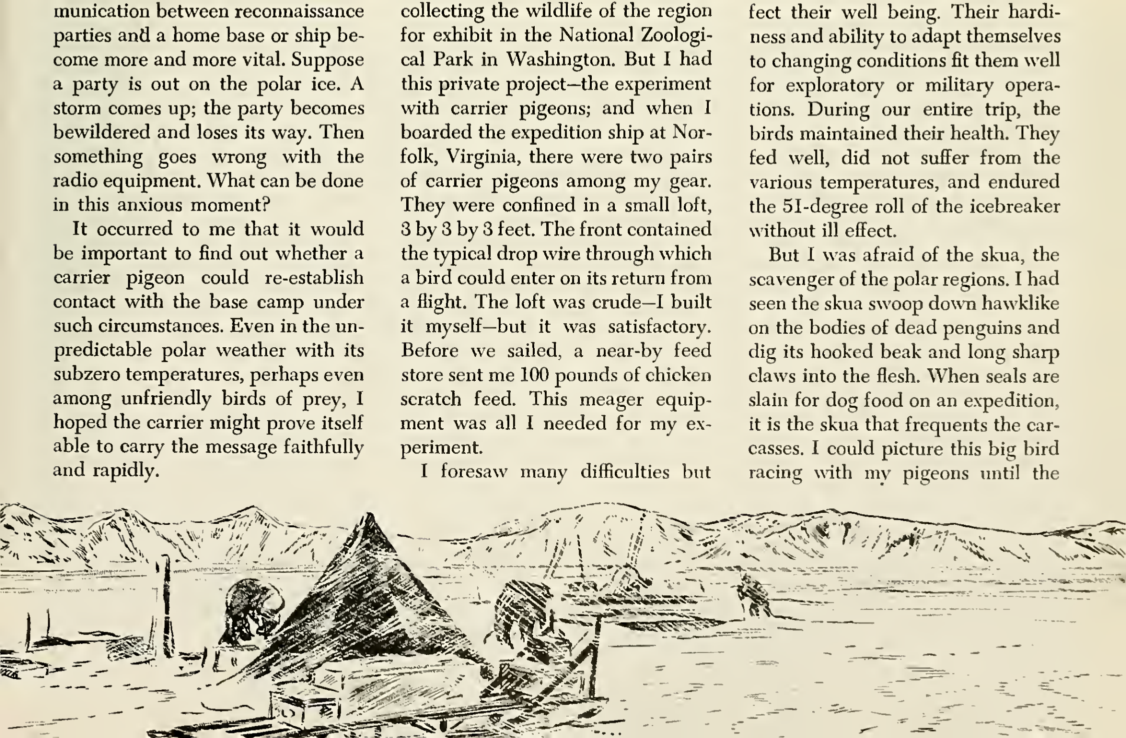
It occurred to me that it would be important to find out whether a carrier pigeon could re-establish contact with the base camp under such circumstances. Even in the unpredictable polar weather with its subzero temperatures, perhaps even among unfriendly birds of prey, I hoped the carrier might prove itself able to carry the message faithfully and rapidly.

My experiments were carried out aboard the U. S. Navy's icebreaker "U. S. Edisto." My job was that of collecting the wildlife of the region for exhibit in the National Zoological Park in Washington. But I had this private project—the experiment with carrier pigeons; and when I boarded the expedition ship at Norfolk, Virginia, there were two pairs of carrier pigeons among my gear. They were confined in a small loft, 3 by 3 by 3 feet. The front contained the typical drop wire through which a bird could enter on its return from a flight. The loft was crude—I built it myself—but it was satisfactory. Before we sailed, a near-by feed store sent me 100 pounds of chicken scratch feed. This meager equipment was all I needed for my experiment.

I foresaw many difficulties but was hopeful for the final outcome. The polar weather did not worry me particularly, because the bird had already proved itself under arctic conditions in the last war. I was chiefly worried about other birds that might injure the carrier during its flight—particularly the skua.

The care that the birds required was a simple daily routine. It consisted of drinking-water and a handful of seed for each bird. If I could not attend to my birds for a day, the lack of food did not in the least affect their well being. Their hardiness and ability to adapt themselves to changing conditions fit them well for exploratory or military operations. During our entire trip, the birds maintained their health. They fed well, did not suffer from the various temperatures, and endured the 51-degree roll of the icebreaker without ill effect.

But I was afraid of the skua, the scavenger of the polar regions. I had seen the skua swoop down hawklike on the bodies of dead penguins and dig its hooked beak and long sharp claws into the flesh. When seals are slain for dog food on an expedition, it is the skua that frequents the carcasses. I could picture this big bird racing with my pigeons until the



carriers were weary and then, with a rasping caw, swooping down and putting them to death. It was the one great hazard with which my small loft of pigeons would have to contend.

The skua is the southernmost bird on the globe. It is abundant within the Antarctic Circle during the polar summer, and it was observed by Amundsen and Mawson inland over the Antarctic continent. It breeds upon all suitable shores of the continent and its islands. It winters chiefly at sea, probably in the ice pack.

The first flight ever made by a carrier pigeon within the Antarctic Circle took place on the morning of January 27, 1947. The flight was from the deck of the "Hashidate Maru," of the Japanese whaling fleet, to the home loft on my ship. I had obtained special permission to board this ship, where I was greeted by Major Waldon C. Winston,[*] American control officer of the whaling operation. He was surprised when, like a magician pulling a rabbit from a hat, I reached into my bulky cold-weather clothing and pulled out my carrier pigeon and released it.

Through my binoculars, I followed the flight of the bird as it circled and then headed for the home loft. It was a brief but successful flight. The ships were only about a mile apart.

Flight No. 2 was from Ross Island to my ship as she lay at anchor in McMurdo Sound. Ross Island is about 43 miles long from north to south and about 45 miles wide. Dominating the region of McMurdo Sound is Mount Erebus, 13,200 feet high. This is an active volcano, snow-covered and expansive. The active crater is about 12 miles in diameter and 900 feet deep, with vertical walls. Numerous eruptions were observed by the Shackleton Expedition in 1908.

It was my good fortune to be able to go ashore on Ross Island and collect penguins from the rookery that surrounded the former base used by Sir Ernest Shackleton. Upon landing from the gig, I reached into one of the spacious pockets of my field jacket and released a carrier hen.

The bird circled twice and then was immediately pursued by two skuas. Off the birds went over Mt. Erebus and out of my range of vision. I was afraid that this was the last I would ever see of my little carrier hen, because I didn't suppose she would be able to evade the skuas.

But when I got back to the ship in the late evening, there was the little hen, very much at home on her nest —her mate happy over her return.

Four other flights were made from Little America to the ship while she was tied to the ice in the Bay of Whales. The procedure was about the same in each case. I usually rode a "weasel" from the ship to the base and then liberated my birds. Always there was the thrilling chase by the skua, for the predatory gull was abundant in that vicinity. Always the pigeons succeeded in outmaneuvering the bird of prey.

It was an exciting sight to watch a pair of pigeons pursued by two or three skuas. First the birds would maneuver around like fighting planes jockeying for position. Then off they would go over the huge ice barrier and disappear. I believe that the pigeons deliberately led the skuas into a chase and enjoyed outsmarting their pursuers. Always there was that anxious doubt as to what might have happened to the birds. But always when I returned to ship, there they were.

The training of a homing pigeon begins when it is about three months old. It may be taken to the distance of about a mile from its loft and liberated in order that it may fly back. After a day or two, it should be carried three miles from home in the same direction and set free. For the third lesson, a few days later, the distance is usually increased to six miles.

During the season the training is continued, gradually increasing the distance until it is about 200 miles. Speeds of over 90 feet per second (about 60 miles an hour) have been recorded for various pigeons, but the average speed is rather less than half that amount.

The hardiness of the carrier pigeon and its power to endure and thrive under adverse conditions is amazing. It is swift of wing and enjoys flying and circling in flocks. Carriers can be seen on windy days going with the wind and at times enjoying the strong currents that toss them around.

The Signal Corps of the U. S. Army maintains a pigeon unit at Fort Monmouth, New Jersey. The Army birds have distinguished themselves in both World Wars. The courageous pigeon "Cher Ami" is a symbol of their daring, and the names of many other brave birds are written across the pages of history.[*]

My experiments now indicate that it is practical for a polar expedition to include carrier pigeons in their equipment for use as emergency messengers. Because of the hardiness of the birds, their care does not present a difficult task. Each bird would require about two cubic feet of loft space. The bird should be furnished with one handful of grain a day, plus drinking water. During subzero weather, it should be protected from winds; and ample material such as straw, excelsior, or other similar stuff should be kept on the floor of the loft to protect the feet.

Although the flights in my experiments were made during the antarctic summer, the ability of the pigeon to adapt itself to new environments leads me to believe that successful flights may be completed even under severe polar conditions.

In recent months our defense of the north polar regions appears to be paramount. With this in view I am developing from the nucleus of the birds that flew in the antarctic a "cold-weather strain" of carriers. They will be offered gratis to any serious polar expedition that may be interested. It is hoped that the armed forces will obtain a few of these birds and use them on their forthcoming maneuvers.

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[*] Now Lt. Colonel, author of the article "The Largest Whale Ever Weighed," in the December, 1950, Natural History.

[*] See "America's First Air Mail," by Curtis Zahn; "Champion of Champions," by John K. Shawvan; "Feathered Battalion Again Takes Wing," by Rory O'Shane; "Miracle on Wings," by J. Rodger Darling; and "Pigeon #183/14 A.F.," by Sydney Moorhouse, in Natural History for Oct. 1943, Sept. 1941, Sept. 1941, Nov. 1940, and May 1940, respectively.

thermometer hung from the center of the dome so that the mercury bulb is at shoulder level to men sitting on the bed platform. A foot higher up, it would be materially warmer.

If once raised above the freezing point, an oval snowhouse seven by nine feet, occupied by four men, should not drop again below freezing for a week, though the trap door be always open. After that, it may drop below freezing and continue to drop lower as the snow of walls and roof gradually becomes more compact and thus a poorer insulator.

VILHJALMUR STEFANSSON

New York, N. Y.

Birds and Lightning

SIRS:

In her interesting article on Audubon (January, 1951), Lucy Salamanca refers to a sudden storm described by Audubon. She terms it a "brief hurricane" and says that "sharp yellow streaks of lightning flashed across the water, striking a pair of whirling hawks . . ." Constance Rourke, in her biography *Audubon*, mentions this same storm. She notes that it lasted half an hour, and she seems more in tune with contemporary usage when she refrains from dubbing it a "hurricane." In her version, the birds are still whirling and still struck by lightning, but they have turned into a pair of nighthawks. I dare say that is just what they were, but I'm a little puzzled about the two of them being struck by lightning and plummeting into the sea.

Was Audubon perhaps being a little dramatic? The nighthawks I've seen in Florida are masters of whirling and plummeting and frequently *act* as if they had been struck by something even on the clearest of days.

Can you provide further information concerning birds and lightning?

Sarasota, Fla. WILLIAM B. KIP

The following information is offered by Dr. John T. Zimmer of the American Museum's Bird Department:

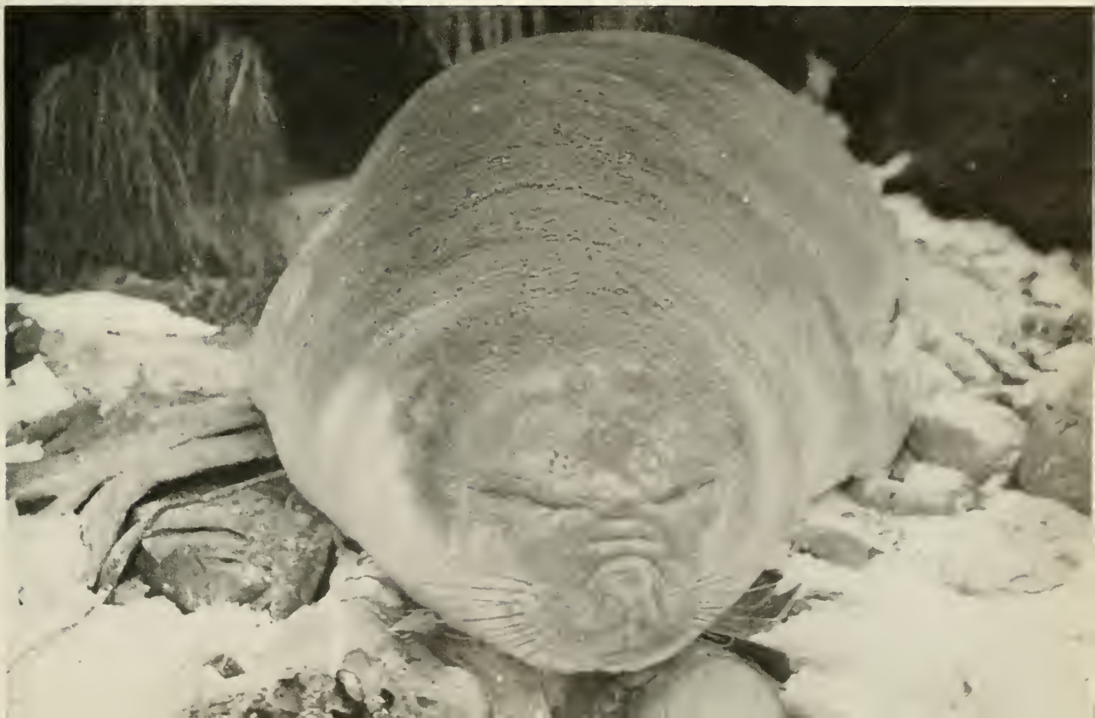
Audubon need not be accused of unduly dramatizing an observation when he reported having seen two nighthawks killed by lightning during a storm. They were nighthawks, incidentally, that he reported and not hawks of another sort. At any rate, his observation has the support of more recent observers, although reports are not numerous. Possibly this may be due to the limited number of individuals, both observed and observers, abroad during severe storms.

Some of the published accounts are speculative in that the birds were not actually seen to be struck or to fall. Some of the dead individuals later picked up may have been killed on the ground. although the evidence indicated that disaster overtook them in the air. One report leaves no doubt on that score. A large flock of lesser Snow Geese and Blue Geese was noted in flight when a sudden sharp flash of lightning was seen close by. A large number of the geese immediately fell toward the ground. Some of them recovered before reaching it and flew away, but more than 50 struck the ground. One of these promptly recovered and flew off, another was still alive but died shortly afterward, and the remainder were dead. Of these, one was badly mangled and several others were broken up inside, but none showed any sign of scorching. Audubon reported a similar lack of any indication of burning on his nighthawks, or any other signs of injury. On the other hand, some of the other published accounts mention strips denuded of feathers or partially torn or dismembered bodies of one or two of the individuals among those found dead, but still without signs of burning.

It is certain, therefore, that birds are sometimes killed by lightning while flying. Some may be killed by the direct electrical charge, some by aerial concussion, and some by striking the ground with sufficient force to rupture the internal organs. In the case of a large flock. as in the instance just mentioned, all three methods may come into play.

▼ A YOUNG SEA ELEPHANT, asleep in the snow on Marion Island, almost 1500 miles southeast of Cape Town. If you want to see how it reacted when the photographer clapped his hands, turn the page . . .

E. O. Hoppe photo



continued from page 110

short-lived in the tropics. Night rises from the lowest valleys almost on the heels of the afternoon which is retreating in the hills. It is a lonely, long race to reach the village or ship before blackness and mosquitoes mix in your path.

The last fuzzy twilight of dusk was fading rapidly when I reached the level road that ran through a coconut grove not far from the coast. My mental relief was great, and I could afford once more to dwell on thoughts of cannibals and being lost. Without warning, the figure of a large native loomed in front of me. A huge Fijian stood with feet set aggressively astride my way. He was holding a large war club. His huge crop of fuzzy hair and glittering white teeth were all that was needed to make that prickling sensation and heart thumping return. Was I walking on a sacred burial ground?

Then I saw that the great show of teeth was in performance of a friendly smile.

"*Mbula!* You like to buy war club?" he asked quietly in a clear English accent.

I burst out into a laugh of relief. "Very much so! Yes, how much?"

The usual answer to such an inquiry came: "One pound."

Four dollars! I was ready at that moment to pay twenty-four! I was penniless at the moment, so I finally traded my shirt and took the club.

The Fijian accompanied me to the main road, and as we were about to part, he pulled from the folds of his *sulu,* or sarong, a large cowrie shell.

"You buy big *mbuli-kula*?" he asked.

Mbuli-kula is the native word for the golden cowrie. I struck a match and held it close to the shell. It was a large flawless specimen with a rich orange hue. I blew out the match to conceal my excitement and began a fifteen minute bargaining bout of feigned indifference and declared poverty. I knew it was now or never, for yesterday's promised bargain in the South Seas is tomorrow's regret.

Hatless, shirtless, without knapsack and pants, I crept up the junk gangplank, a little late for supper; but with me I carried a war club and a golden cowrie. I also carried a firm resolution to start back early on all future treks into the hills.

The "Cheng-Ho" made several more stops in the Fiji Islands during the next few weeks, and from there went east to the Samoan Islands, where I continued shell collecting for another four months, on Tutuila Island. Most expedition accounts end in glowing tales of success, but I was able to obtain only one more golden cowrie, and under circumstances not unlike my Tunoloa experience. I am still in search of a living adult specimen and a set of its eggs, but I find that with each new tropical island explored, whether for the golden cowrie or the Glory-of-the-Seas cone shell, it is the searching and not the finding that brings the richest rewards.

. . . SUDDENLY ROUSED from its peaceful slumber, the rotound animal looked as alarmed as a man who has just remembered that his income tax is overdue

E. O. Hoppe photo

"The bonds we bought for our country's defense are helping our boy become a doctor!"

HOW U. S. SAVINGS BONDS
ARE PAYING OFF FOR
JOHN AND HELEN DALY
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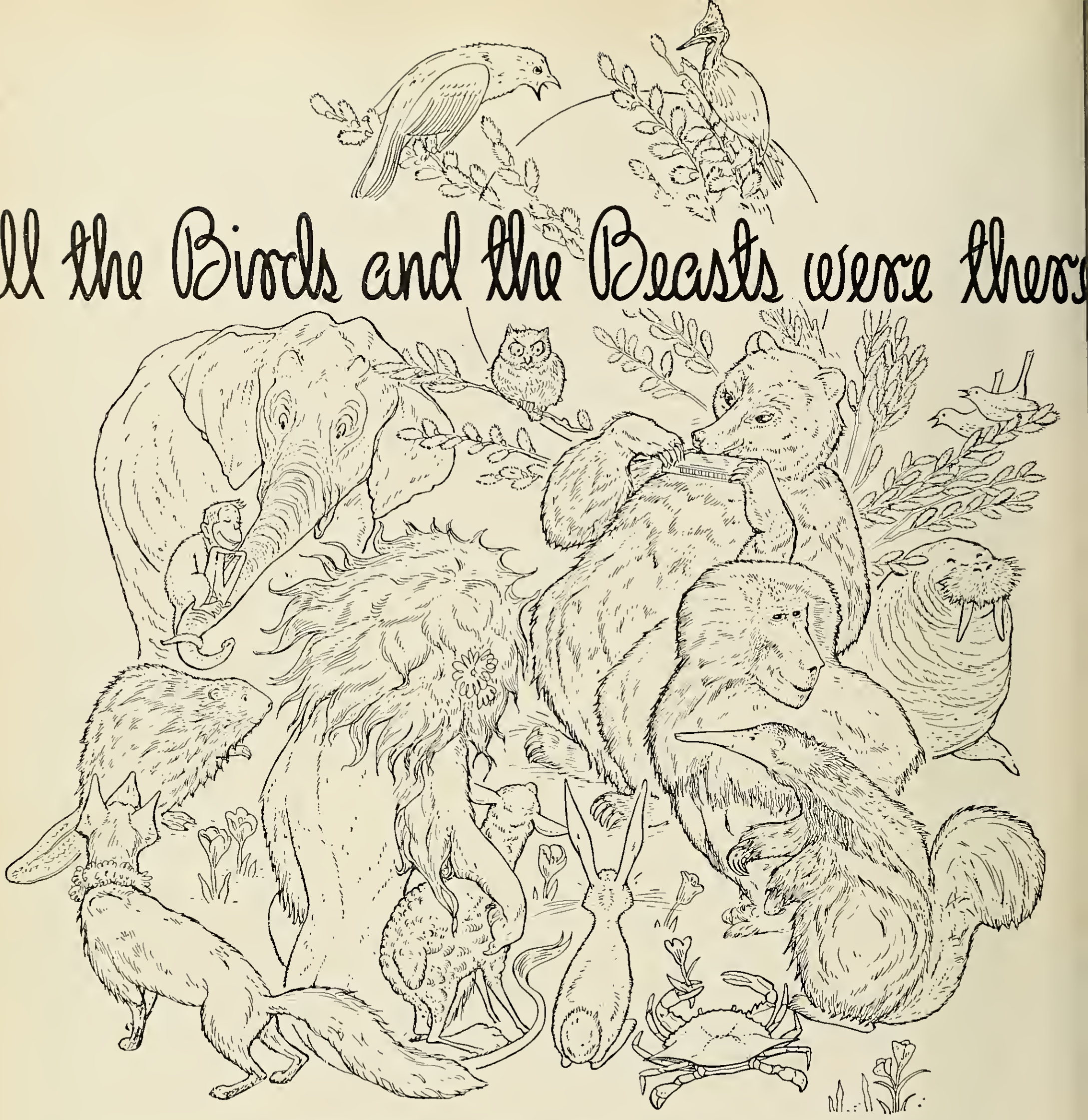
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April **NATURAL HISTORY** 195

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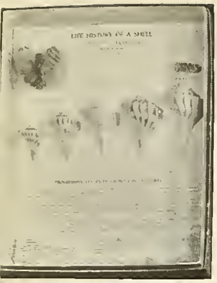
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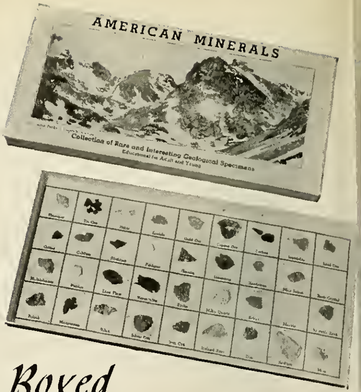
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Who named this beast the "riverhorse"

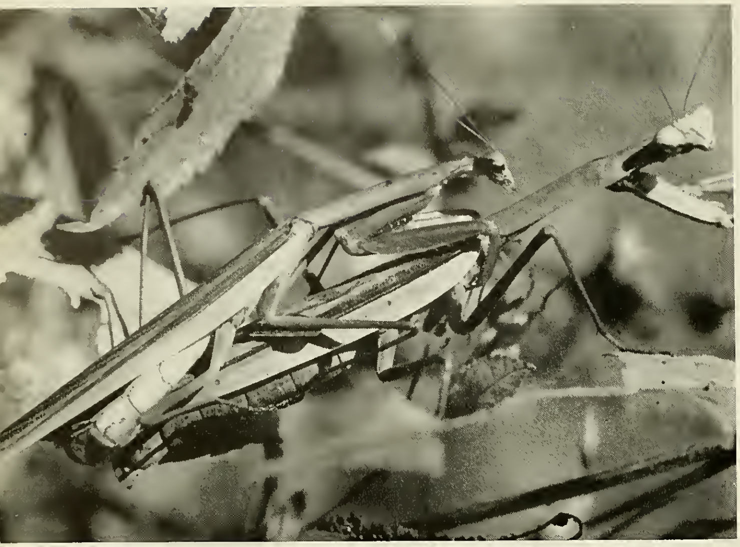
LETTERS

Beware the Collectors

SIRS:

Thanks so much for the February issue of NATURAL HISTORY. "Sky Islands of Arizona" by Weldon Heald is certainly well written. However, we are very much concerned about the collecting of both birds and mammals in these mountains, and especially in the Huachucas. The areas are small, and collectors come from all over. They all want to take hundreds of specimens. How long can this go on?

We would like to have some help in establishing an inviolate sanctuary there, where wildlife can be studied but not disturbed. Too many people are always eager to pile up a lot of dead skins, and



▲ An exceptional photograph of two praying mantises mating, by A. J. Arfsten

too few want to establish a safe haven for wildlife. Through efforts of the Tucson Audubon Society, and by order of the U. S. Forest Service and the Arizona Game and Fish Commission, Madera and Florida Canyons are now closed to collecting of all kinds. These canyons are in the Santa Rita Mountains. The Trogons, despite absolute protection, are just about gone from there. We were responsible for the egg collector being caught and fined in Madera Canyon in 1946.

We appreciate having William Carr to help with conservation measures; the pressure by hunters in this state is terrific. They are exerting every effort to have Saguaro National Monument opened to hunting right now, and they did succeed in opening Tucson Mountain Park to shooting last year.

Ross and Florence Thornburg
Tucson, Ariz.

Richard H. Pough of the Museum's Department of Conservation agrees that the extirpation of local races of birds seems a high price to pay to enable a few more museums to have a complete series of skins.

Singed Feathers and Cold Feet

Sirs:

We have been reading of the effect of thermal currents on birds' flight in Maurice Broun's *Hawks Aloft.* Do these currents also exist on a smaller scale in the case of small fires and hot objects?

The reason for asking this question is that we like to allow our canaries the freedom of the house and wonder what dangers exist for them. Would they be apt to land on the stove while the oven is on, or land on a hot pan over the direct flame, or on a hot iron? Are birds' feet very sensitive to warmth?

(Mrs.) Katharine C. Jones
Wausau, Wis.

The following remarks are offered by Dr. John T. Zimmer of the American Museum's Bird Department:

There is no doubt that thermal currents exist wherever there is heated air rising, but in the case of relatively small hot objects such as a hot pan or iron, it is doubtful that the current would be strong enough to have a very disturbing effect on a bird flying near or through it. The bird probably would be aware of the current but would be quite able to cope with it.

The question of possible injury to birds alighting on the hot object is more immediate. Nevertheless, there appears to be good evidence that a bird can perch or stand on quite hot objects for an appreciable time without harm, although the literature on the subject is very limited. The only report I have seen that is at all illuminating was published by L. T. S. Norris-Elye in *The Auk* (vol. 62, p. 455, 1945). He reported Canada Jays perching on the rim of an iron pot that was standing on an almost red-hot stove and remaining for 30 to 40 seconds before leaving. Several times they stood on the stove itself for five to eight seconds, showing a little nervousness but no actual discomfort.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

At the other end of the scale, it is common observation to see ducks paddling actively about in icy water. It seems quite certain that birds' feet must be almost impervious to considerable thermal severities. The feet are composed largely of tendons and bones covered with scaly integument (sometimes reinforced with feathers for added protection but usually not), and there is little moisture present to freeze or be affected by heat. It is possible, even, that the blood circulation may be withdrawn from these extremities during times of the greatest severity. At any rate, it has been calculated that if a bird in subzero weather were obliged to keep its exposed feet at the regular temperature of its body, it could not eat enough food to overcome the heat loss and survive. Some mechanism must exist to allow the extremities to approximate the outside temperature without affecting the body as a whole. If this is true, extreme heat, short of actual burning, could be tolerated for a time—at least until it reached, by conduction, a more vulnerable place.

There appears to be little danger, therefore, to canaries that might encounter some hot object in the room, except an open flame that might suddenly singe their feathers and cause them to drop into it.

Protection against Porcupines

Sirs:

I would like to make inquiry regarding porcupines. A lady living in Ohio, who with her husband has a hunting lodge in Pennsylvania, tells us that they are very much troubled with porcupines eating the framework of the lodge. She wonders if anything can be done to deter the animals or keep them away. Do your mammalogists have any solution?

Roy C. Thomas,
Associate Pathologist

Ohio Agricultural Experiment Station,
Wooster, O.

The following information is offered

Continued on page 190

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The Magazine of the American Museum of Natural History

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VOLUME LX—NO. 4
APRIL, 1951

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You will find NATURAL HISTORY *Magazine indexed in* Reader's Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The full-color photograph on this month's cover, taken by Walter Henricks Hodge, has more than artistic interest. In the similarity of pattern on the flower and the butterfly, one wonders whether there might be an example of parallelism in the plant and animal kingdoms. The flower is one of the wood lilies, *Lilium philadelphicum.* The butterfly is one of its common pollination agents, a meadow fritillary of the genus *Argynnis.* This butterfly visits many flowers of the woodlands.

The cutaway base of this flower is common to all vertical standing lilies, and it has been suggested that this has survival value for the plant. During heavy summer showers, the rain passes to the ground without washing out the nectar upon which the flower is dependent as a lure for the insects that pollinate it. Lilies with a closed cup catch no rain either, for they always grow "mouth down."

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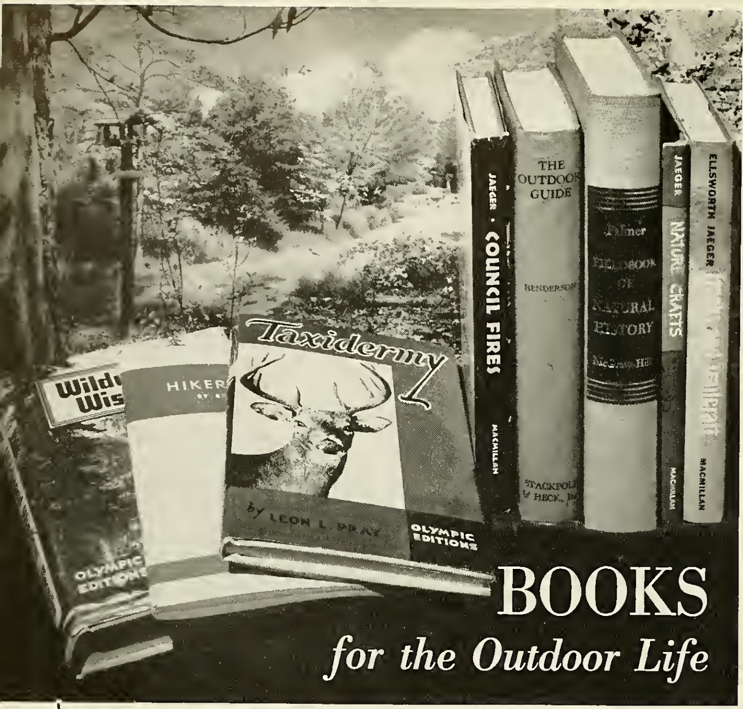

Tracks and Trailcraft

By ELLSWORTH JAEGER

*381 pages, $3.95 plus .10**

An account of prehistoric and present-day animal tracks and how to read them, written for both children and adults by the Curator of Education of the Buffalo Museum of Science. Hundreds of tracks of mammals, birds, amphibians, reptiles, insects, and mollusks are described, with clues for interpreting them. Many black-and-white drawings.

Wildwood Wisdom

By ELLSWORTH JAEGER

*491 pages, $3.49 plus .10**

A practical, comprehensive book for both the beginner and the experienced woodsman, covering almost every aspect of living and traveling in the woods. Chapters include clothing, packs and packing, blankets and beds, shelters, fire making, sanitation, cookery equipment and recipes; useful and dangerous animals and plants; canoeing, trailcraft, and stalking and calling animals; Indian lore and crafts; and how to make camp furnishings. Many useful drawings.

Fieldbook of Natural History

By E. LAURENCE PALMER *664 pages, $5.50 plus .15**

A comprehensive listing of thousands of natural history types and specimens, arranged according to their scientific classifications in the fields of astronomy and mineralogy, and all divisions of the plant and animal kingdoms. Each living form is represented by a line drawing, description, and account of habitat, type of reproduction, and uses. Minerals are shown in photographs. The author is Professor of Nature and Science Education at Cornell University.

The Outdoor Guide

By LUIS M. HENDERSON *351 pages, $4.50 plus .10**

An artist-woodsman gives advice on outdoor living in a beautiful book that covers the ways of wild creatures, how to prepare for outdoor living, methods of travel, housekeeping, eating and sleeping in the wilderness, and how to provide for accidents. Illustrated with handsome black-and-white drawings of American wild animals and scenes from outdoor life.

Hiker's Guide

By BEN SOLOMON *95 pages, $.60 plus .05**

A beginner's pamphlet on proper hiking and camping equipment and procedure: what to take; what to wear; how to tramp, make shelter, and cook; and how to solve the problems of fire, weather, and accident or illness.

Council Fires

By ELLSWORTH JAEGER *253 pages, $2.95 plus .10**

The ancient council fire adapted to modern use in camp and community groups. With the help of many drawings, the author explains fire building, types of council rings, fire lighting and peace-pipe ceremonies, and appropriate games, stories, contests, and authentic Indian dances to be used at the council fire. Special directions are given for making suitable headdresses and musical instruments.

Nature Crafts

By ELLSWORTH JAEGER *128 pages, $2.49 plus .10**

Crafts activities for home or camp are simply described and clearly illustrated in many drawings. Fields, woods, and vacant lots supply the natural materials, and the simplest tools are used. Instructions are included for making Indian mats, arrowheads, knives, whistles, totem poles, kachina dolls, pack frames, and snowshoes, in addition to many other useful articles made of natural materials.

Taxidermy

By LEON L. PRAY *89 pages, $1.69 plus .05**

A simple book for hunters, fishermen, and others who want to learn to mount a fish, a bird, a small mammal, or a large mammal head. Lists are included of working equipment, and steps in the work are shown in numerous drawings.

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THERE'S ALWAYS ADVENTURE

--- by Grace E. Barstow Murphy

Harper and Bros., $4.00
299 pp., 45 illusts.

THE author begins with the avowed intention of blowing the "wifely horn" for those wives who have lived unsung in "the shadow of the Lion." She meets modern woman's dilemma head on, frequently with outspoken resentment but never with malice. It makes a warm and lively book.

Mrs. Murphy did not travel for escape. Often she had three children with her. But whether with family or friends or alone, she always took along herself, her eager mind, sympathetic heart, and questioning spirit. There is a bouyant determination to get the most out of each experience—whether a dizzy ride over the Andes, an albatross in flight, a native dish, an unfriendly sea lion, or a desert night. There is a simple gratitude that takes nothing for granted, whether lilacs at her Bronxville window or the courtesy of her Ecuadorean hostess. There is a gleeful gratitude for the chance to show that she can take it as well as the explorers when the gales strike, the mud deepens, or the water runs out.

Her style, unorthodox with its feminine disdain for intervening steps, suits the breathless tempo. The description of the penguins in the Snares Islands is enchanting.

The bulk of the book is travel and natural history, but she never strays from the problem of being both a person and a wife, with its frustrations and compensations. It is a startlingly frank exploration into marriage. And where insight fails there is saving humor and quick sympathy that few can match.

You may say that despite her frankness, her emotional spontaneity, her earnest effort to understand intellectually, she doesn't always come up with the final answer. But who wants to read a book that gives all the answers? Each reader will find himself hunting for his own. That is the fun. And that is the reason *There's Always Adventure.*

Susann Weyer

WILDLIFE MANAGEMENT

---------- by Ira N. Gabrielson

The Macmillan Co., $4.50
274 pp., 40 illusts.

DR. GABRIELSON captions his last chapter with the question: "Can Public Hunting and Fishing Be Maintained?" His answer is a qualified "yes," and his reasons for so qualifying his answer become apparent as one reads this interesting book.

Wildlife Management deals in a popular, nontechnical manner with the conservation, use, and management of those forms of wildlife that we classify as game. No man in America writes with greater authority on the subject than Dr. Gabrielson, who now heads the Wildlife Management Institute after a long career with the U. S. Fish and Wildlife Service.

The picture he paints is not a pleasant one. True, we no longer slaughter game for the markets, but even that slaughter left more of many species than we have today after a century of drainage, dam building, overgrazing, and soil erosion. Within the past decade modern high-speed mowing machines, more potent insecticides, and clean fence rows have further accelerated the decline of farm game even on our good lands. Yet, despite this decline, 20 to 30 million Americans go forth each year with rod and gun expecting to bring home at least a few trophies of the chase.

Although we are admittedly faced with a crisis with respect to many species, Dr. Gabrielson paints from firsthand knowledge a picture of waste, inefficiency, and lawlessness that is a serious indictment of our honesty and common sense. Half of our states still virtually throw away their game funds on politically appointed staffs that accomplish little except to cater to the foolish whims of barber-shop experts. Too many conservation department directors still try to "give the sportsmen what they want" instead of honestly letting them know what they can reasonably expect to get. Too many legislatures still try to set every detail of the hunting seasons and bag limits on a basis of political expediency instead of leaving the matter to experts who have some idea of how much game is going to be available. That much could be done is apparent from the examples cited in this book. However, it will never be done until the conservation job is assigned to trained professional men whose expert advice we accept as we do that of the family lawyer or doctor.

Richard H. Pough

THE LAND OF THE CAMEL

Tents and Temples of Inner Mongolia

----- by Schuyler Cammann

The Ronald Press Co., $5.00
200 pp., 39 illusts.

STRANGELY enough, as a member of a United States Navy team, Dr. Cammann was sent on a mission into the Ordos Desert of Inner Mongolia during 1945. His duties were not arduous, and particularly after the Japanese defeat, when he was unable for a number of weeks to return to Chungking, he had

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time to travel about and get to know the Mongols and Chinese of the region and also to explore a number of the Mongol Lamaist temples. Able to speak Chinese and being an expert on Far Eastern art—now in the Chinese Department of the University Museum, University of Pennsylvania—he made very good use of his time.

The book at hand is a narrative of these experiences. It is not a tale of high adventure, although Dr. Cammann and his friends had their share of curious encounters with the Mongols and Chinese, of trucks broken down in the desert, and the riding of camels in lieu of those trucks. More important are his observations of the people and their customs and the predicament of the Mongols, whose traditional way of life is being snuffed out by the encroaching Chinese. And still more in line with the author's particular interest are the accounts of his many visits to the Mongol Lamaseries, temples of the Tibetan-Buddhist faith, which retain many elements of the ancient Asiatic religions.

This is a pleasant and very readable book. In the running account of his travels Dr. Cammann manages painlessly to impart a formidable amount of information on an interesting area and one that is of particular importance in world affairs at the present time. Only on looking back at the book is one aware that he has come to know rather well a strange segment of the world's people. I recommend it highly.

Gordon F. Ekholm

ELEPHANT BILL

- - - - - by Lt. Col. J. H. Williams

Doubleday and Co., $3.00
250 pp., 42 illusts.

COLONEL WILLIAMS has written an interesting and authoritative account of training elephants for work in the teak forests of Burma and of using these intelligent beasts during the critical days of the Japanese invasion.

The author might be called an elephant career man. He has devoted many years of his life to acquiring a knowledge of their ways, and he is in as close harmony with them as it is possible for a man to be. The reader of this book will conclude with feelings of admiration for both the elephants and "Elephant Bill."

The story is simply written, and because there is no conscious striving for effect, the impression is one of sincerity. There is plenty of drama, nevertheless, for elephants are powerful and get out of control at times. War brought to Burma situations that challenged the utmost in the animals and the men who handled them. The reader is given many firsthand incidents of how this challenge was met.

Colonel Williams is a good observer and has an understanding and sympathetic affection for elephants and for the natives who are so closely associated with them. Since the elephant's span of life is about that of man, frequently an elephant and its master spend an entire lifetime together.

So far this mechanized age has not developed a machine that can equal the elephant for efficiency over much of the territory where teak is grown and harvested. Under the pressure of war it was proved that elephant transport could do things beyond the capacity of wheels and wings. Where nature was raw the elephant was in his own.

The book has a number of half tones which illustrate much of the underlying pattern of elephant behavior. They also give some insight into the environment and show the fine type of native who works with elephants in Burma.

Harold E. Anthony

SCIENCE AND COMMON SENSE

- - - - - - - - - by James B. Conant

Yale University Press, $4.00
371 pp., 32 figs.

THIS volume is phrased for the layman, and the selection of subject matter includes concepts that have revolutionized scientific thought and directed the destiny of man.

Much space is given to defining the criteria that distinguish science from other disciplines of thought. "Science is an interconnected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observations."

A scientist should be skeptical. People develop habits of thought and take for granted fundamental assumptions that will not meet the test of sufficiently critical analysis. The author shows how the thinking of centuries has been conditioned upon acceptance of concepts that seem absurd to us today. Some of the current scientific philosophy may seem as queer to the people living one hundred years from now. Doubt as to the validity of concept should have a reasonable basis; in brief, it must be a challenge to common sense.

An element of timing enters into the progress of scientific thought. A concept may appear before man is ready for it, and years may pass before the idea receives the acceptance it merits. In other instances, man has seemed to be awaiting the idea and eager to put it to use.

Concepts may be the end result of long experimentation; they may arise as "hunches" with rather sparse antecedent rationalizing. Science may be pure; it may be applied; it may follow a line that has a certain termination; it may lie in fields with infinite possibilities.

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The examples of great forward strides in science are often familiar demonstrations in the physics laboratories of high schools and colleges. Higher mathematics is not involved, and the concepts are those of a finite universe. The pattern of success in scientific thinking seems to be as clearly demonstrated by these simpler illustrations as by the mysteries of nuclear fission or variable yardsticks.

This is not a book to gulp at a sitting. It well repays the deliberate reading it requires.

HAROLD E. ANTHONY

CULTURE IN CRISIS:

A STUDY OF THE HOPI INDIANS

- - - - - - - - - by Laura Thompson

Harper and Brothers, $4.00
221 pp., 45 illusts.

TO those who are accustomed to regard anthropology as an esoteric science, unconcerned with practical affairs, Dr. Thompson's study of the Hopi Indians should prove a rewarding experience. In essence the book is a clinical diagnosis of the cultural crisis at present confronting the Hopi and a concise analysis of the major contributing factors. The author also makes sensible suggestions as to ways in which the crisis might be resolved effectively and offers sound advice to Hopi administrators. The implications of this book are not, however, confined merely to the 4000-odd Indian inhabitants of the Hopi reservation in northeastern Arizona. As John Collier points out in his introduction, the approach to the Hopi problem has forged an instrument of study applicable in far broader situations of trusteeship administration.

The present study is the result of one of a series of tribal investigations conducted under the joint auspices of the United States Office of Indian Affairs and the University of Chicago, and the ultimate goal of this project was to implement the effectiveness of the Indian Service program. Over 50 scientists from many disciplines participated in the Hopi project alone, as well as representatives of the Indians themselves. This battery of researchers assembled evidence which discloses that the Hopi suffer from insufficient land, overgrazing, overpopulation, poor health, and inadequate diet as well as destructive ideological pressures from without. Investigation also revealed that these problems may not be resolved without constantly taking into account Hopi personality and culture.

Although Dr. Thompson's interpretation of Hopi society differs in some very important respects from that of other specialists, we cannot afford to ignore her central thesis: namely, that if the world's people are ever to live together in harmony, the principle of cultural autonomy must be recognized, accepted, and respected.

HARRY TSCHOPIK, JR.

OUR DESERT NEIGHBORS

- - - - - - - - by Edmund C. Jaeger

Stanford University Press, $5.00
239 pp., 13 plates, 33 photos, 20 drawings

A CASUAL visitor hurrying across the deserts of southwestern United States by auto or train would consider the country almost devoid of animal life. An occasional bird, jack rabbit, antelope ground squirrel, or, if one is fortunate, a coyote may be seen making a hasty retreat. But if one is interested and takes time to investigate, he will find that there are innumerable tracks showing that the desert supports a large number of interesting creatures, whose acquaintance is well worth the effort. One reason for the seeming scarcity of life is that most of the animals are nocturnal.

Edmund C. Jaeger has explored these deserts for more than 40 years and has lived in close intimacy with the wildlife found there. He is a man capable of writing in a most informative and interesting manner, and one is fortunate to be introduced to these creatures through his observations.

There are 37 chapters in this book, each dealing with a specific form or a closely related group. One chapter of outstanding interest tells of the hibernating habit of the poorwill, the western representative of our eastern whippoorwill. Many years ago the general belief was that birds hibernated; swallows and swifts were thought to bury themselves in the mud and other birds to retire into hollow trees for the winter. Later, when the winter ranges of these birds were discovered, the idea that birds hibernated was discredited. Now, however, Mr. Jaeger has proved that some birds do occasionally hibernate.

Good photographs illustrate the book, and drawings head many of the chapters. I enjoyed reading the text and feel sure that my next visit to these deserts will be of much greater interest through the knowledge that I have obtained from the pages of this book.

T. DONALD CARTER

SEQUOIA NATIONAL PARK:

A GEOLOGICAL ALBUM

- - - - - by François E. Matthes

Univ. of California Press, $3.75
136 pp., 125 illusts.

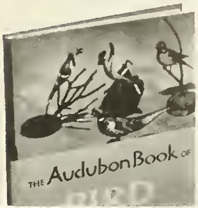
THIS volume is, in a sense, a companion to Dr. Matthes' recent *The Incomparable Valley*, a popular account of the geology of the Yosemite National Park. It differs, however, and is unique among geologic volumes in the method of the treatment of its subject. Formal text is kept to a minimum, the story being told by means of 112 photographs and 13 diagrams, all with somewhat extended titles. The photographs show exceptionally well the geologic features being considered. Unfortunately, their reproduction suffers somewhat from the paper used; a glossy paper would have afforded better rendition of some of the finer detail.

The history behind the volume emphasizes its authenticity as well as the value of this method of exposition. Completing his studies in the Yosemite Park, Dr. Matthes turned to the Sequoia area, planning to prepare a geological report on the region. This work was interrupted by the requirements of other geologic problems assigned him. The National Park Service, however, was anxious to have available for use by its ranger-naturalists the geologic information that Dr. Matthes had obtained. At their request he prepared three albums of carefully selected photographs, with a short descriptive text to accompany them explaining the geologic history of the Park. These proved of unusual value both to the ranger-naturalists and to the visitors in the area.

When Dr. Matthes died in June, 1948, without having been able to complete his report on the geology of the Park, it was decided to make his Sequoia albums available to the public. The result is the present volume, issued under the editorship of Dr. Fryxell.

Because the story is concerned with the effects of the geologic processes in the formation of mountain landscape, the il-

Continued on page 192



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Th

Clues hinting that
this Bermudian petrel
might not
have been exterminated
led to an expedition
to locate
its nesting place

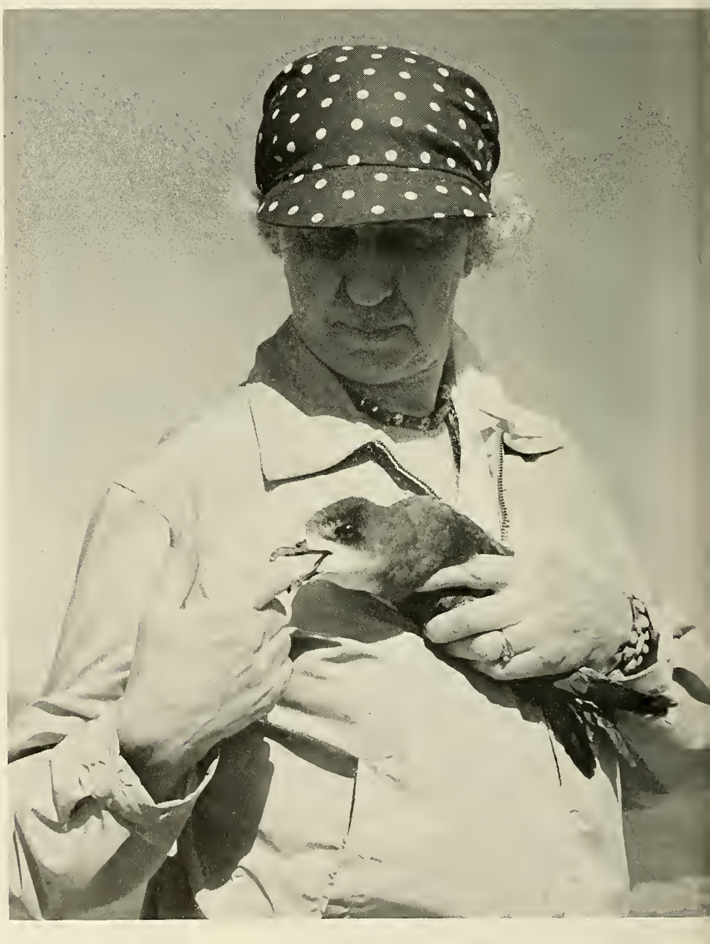
IF we might see Bermuda as it was during the millennia between the end of the Ice Age and the discovery of America, we should doubtless have a glimpse of the primitive world such as only poets and naturalists have envisioned. For Bermuda was one of the few untilled gardens without human beings. When man first arrived at "the still-vex'd Bermoothes," as Shakespeare calls them in the *Tempest,* the cahow dwelt in myriads over the greater part of the Archipelago. It burrowed wherever soil existed and entered the numerous limestone caves and grottoes that date from early postglacial or interglacial time.

In 1619, Governor Nathaniel Butler, of Bermuda, wrote:

"For the cahowe (for so soundes his voice), it is a night bird, and all the daye long lies hidd in holes of the rocks, whence both themselves and their young are in great numbers extracted with ease, and prove (especially the young) so pleaseinge in a dish, as ashamed I am to tell how many dosen of them have been devoured by some of our northern stomacks, even at one only meale."

A still earlier record, unearthed by Dr. William Beebe, comes from a Spaniard before the landing of the English. Don Diego Ramírez reported:

"The first night that I anchored in the bay, I sent a small boat to an inlet to look for water, but none was found. At dusk, such a shrieking and din filled the air that fear seized us. Only one variety of bird makes this noise, but the concerted yell is terrible, and standing out from it were individual voices shouting diselo! diselo! (tell 'em, tell 'em). One seaman said to me: 'What is this devil trying to tell me? Out with it! Let's hear what it is!' I replied: 'A la! These are the devils reported to be about Bermuda. The sign of the cross at them! We are Christians!' While we were in this confusion, the men of the small boat rushed up, exclaiming in their alarm, 'What devils are these? The boat's rudder is broken.' I ordered another to be made immediately, because in the morning the coast had to be searched for water. One Venturilla, a Negro, was sent on shore with lantern and axe to cut a piece of cedar. The moment he landed and entered the bush, he set up such a yell, that I shouted: 'The devil's carrying off the Negro! Everybody ashore!' The men jumped into a boat and rushed to the spot, where the Negro was brandishing his lantern and his fists against the birds, and mingling his yells with theirs. The birds, meanwhile, attracted by the light, dashed against him, so that he could not

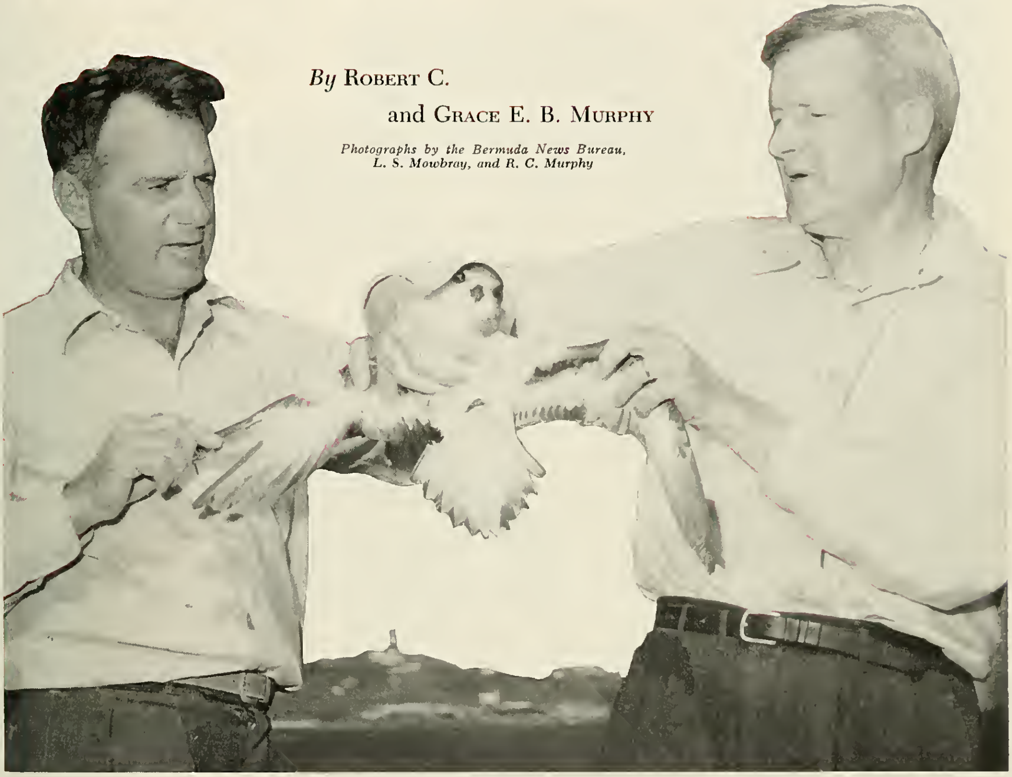


➤ GRACE E. B. MURPHY with a cahow just lifted from its egg. Though it could have drawn blood with its beak, this cahow, like the others handled, proved more playful than pugnacious

AHOW Still Lives

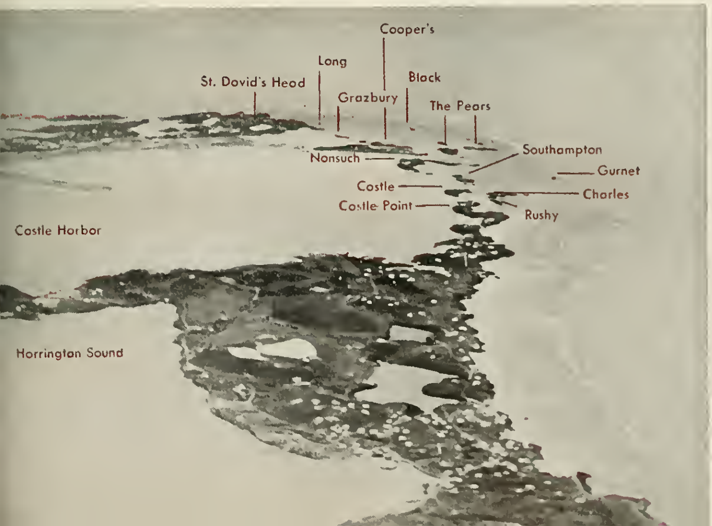
By Robert C.
and Grace E. B. Murphy

Photographs by the Bermuda News Bureau, L. S. Mowbray, and R. C. Murphy



▼ Eastern Bermuda, showing all the islands of Castle Roads. Along the right or southern coast stretches the foam line of the reef

▲ A cahow hauled out of its burrow by pole and noose on an islet a short distance off St. David's Island. Louis Mowbray and Robert Cushman Murphy are about to mark it with a U. S. Fish and Wildlife Service band before releasing it


Cooper's
Long
St. David's Head
Black
Grazbury
The Pears
Southampton
Nonsuch
Gurnet
Castle
Charles
Castle Point
Rushy
Castle Harbor
Harrington Sound

keep clear of them even with a club. Neither could the men of the relief party. More than 500 birds were brought off to the ship that night, and having gone through hot water and been plucked, proved to be very fat and fine. Thereafter a capture was made every evening. The birds were so plentiful that 4000 could be taken in a single bag. The men relished them enough to eat them all the time, and when we left we brought away more than 1000 well dried and salted for the voyage."

Bermuda, like New Zealand, was a land without mammals. The first dangerous interlopers were the crea-

tures that man left behind after his encampments. They were brought by the Spanish discoverers, under Juan Bermudez himself, in the early sixteenth century, or by the buccaneers who followed. These curses were first, pigs, and second, rats. As regards pigs, the motive was to leave a supply of meat for mariners. But the effect upon the defenseless flora and fauna of Bermuda was drastic. It would be hard to conceive any plague more devastating than herds of rooting wild swine. Ground-nesting birds and fruit-bearing plants alike melted away before their onslaught, and we may take it for granted that the cahows had been eaten out of existence over the greater part of Bermuda before the first British settlement in 1609.

▲ **Surmounting Islet "A"** to the limestone layers under which at least six pairs of cahows were nesting

➤ **Louis Mowbray** discovers with his flashlight a mated pair of cahows in a straight burrow eleven feet long. At anchor is the seaworthy Aquarium launch that carried the party to practically all islets of the Castle Roads area

▼ **This proved** to be one of the few nesting chambers that was accessible. Having opened it with a prospector's pick, Dr. Murphy and Mr. Mowbray are examining the green twigs of which the nest was formed. The egg found in this burrow hatched later

The rats, presumably accidental immigrants, were the more or less tropical roof rats that haunted ships. What the pigs had left, the rats finished. Descriptions of the tidal waves of rats in the language of 1610 are quaint but horrible. After making the growth of crops impossible, the rat armies are said to have poured into the sea like overpopulated lemmings.

At the date of British occupation, the cahow still held out in fabulous numbers at the group of islands off Castle Harbor, not far from the first settlement at Ft. George's. To most of these, no doubt, the hogs had not swum. A special center of abundance was Cooper's Island, southwest of the eastern end of Bermuda. The unusual circumstance of a sea bird breeding in the winter of the Northern Hemisphere meant that food could be obtained when other birds were not available. Not long after the famine-haunted season of 1614-1615, the birds were said to have been completely extirpated. The cahow became a legend.

For 300 years its identity and its affinities were not certainly known. It was confused with at least two other species of petrels and even with the members of a quite distinct family, the auks. Not until 1916, when bones from ancient caverns were studied and compared, did the idea gain credence that the cahow was a petrel of the genus *Pterodroma.*

Nobody saw a living cahow again until the year 1906, and then the finder did not know that he had rediscovered it. On February 22 of that year, Mr. Louis L. Mowbray, a Bermuda naturalist who was Curator of the Government Aquarium, managed to land upon the isolated stack called Gurnet Rock, off Castle Roads. He took from a chink a living sea bird, which was first referred to in print by the name of a New Zealand petrel! The specimen was fortunately preserved, but not for another decade was it correctly associated with skeletons of the historic petrel and scientifically described and named, by Mr. Mowbray and Mr. John T. Nichols, as *Pterodrama cahow.* This bird, now in the American Museum collection, is the type specimen of the species. In June, 1935, a fledgling petrel of the same sort struck St. David's light, close to the old nesting ground on Cooper's Island. It came into the possession of William Beebe, then at his laboratory in Bermuda, and he published a spirited account of the rediscovery.

Ten years later, during World War II, an American Army officer, Fred T. Hall, now Director of the Public Museum at Davenport, Iowa, was stationed at Bermuda. Hunting for signs of cahows, he found fragments of birds that had apparently been killed by rats, and even a partly disintegrated adult that had floated ashore.

Here was a fascinating and slightly hopeful chain of events. Petrels ordinarily come and go only at night, feeding chiefly many miles out at sea. They live underground on unoccupied islands. At least a few cahows had evidently survived for three centuries without Bermudians or naturalists elsewhere knowing anything about them. It was hardly likely that the species was any more "extinct" in the year 1951 than it had been in the year 1906. Such was the train of thought. When we divulged it to Mr. Childs Frick, a Trustee of the American Museum, who owns a home in Bermuda, his response was: "That is the most exciting idea I ever heard in my life." He generously contributed to the budget of the Department of Birds a sum that would make possible a field investigation. Mr. Marshall McLean, Treasurer of the Pan American Section of the International Committee for the Preservation of Bird Life, made an additional gift in the name of his organization. So getting into touch with Louis S. Mowbray, present Curator of the Bermuda Aquarium and son of the original rediscoverer, we flew to Bermuda on January 23, 1951.

For a week we lived at the home of Mr. and Mrs. Frick on Castle

▼ SEARCHING for other burrows on the same islet: a view showing the extreme erosion and disintegration of the small limestone islets that are the last stronghold of the cahows

Point and for another ten days at the Bermuda Biological Station for Research, in St. George's West. In company with Mr. Mowbray, who supplied a diesel launch and a peerless knowledge of local waters, and with a young Bermudian ornithologist, David S. Wingate, we made a thorough investigation of islets off Castle Roads when weather permitted. Landing at Gurnet Rock was impossible in the boisterous winter seas encountered. We soon learned that the likelihood of finding traces of cahows was in inverse ratio to the prevalence of rats. Castle Island, for example, is large, accessible, and frequently visited because of its fascinating, well-preserved, seventeenth-century fortifications. Brown rats abound and can be seen even in bright sunlight, and the island has no burrowing or ground-nesting birds. Cooper's Island is now out of the running, for it has been linked up through dredging and filling with St. David's Island and forms part of the Bermuda Air Base.

The first real indication of cahows in residence was found on January 28 at an islet which, for the safety of the birds, we shall call just "A." Like many others in the neighborhood, it is greatly eroded, broken into several nearly distinct parts, and overgrown on the crown with grass, prickly pear, sea lavender, and a few other spray-resistant plants. We scrambled ashore in the forenoon. In several places at levels 20 to 30 feet above the water there were holes in interbedded reddish soil, under or between limestone strata. Fresh earth at the entrances revealed neither scratches nor footprints, but there were soft patches of green and whitish excreta such as are characteristic of squid-eating sea birds. It seemed discouraging at the time that we could detect no trace whatsoever of the familiar musky odor that is ordinarily a telltale of petrels within.

Most of the tunnels were both deep and crooked. Presently we located one in which an electric flashlight revealed a bird in the nest chamber. The entrance was at the rear of a rocky niche large enough to accommodate a man's head and shoulders. Four feet within, a horizontal excavation seven to eight inches in width and somewhat less in height had been bored in a straight line to a depth of just over six feet. With a noose at the end of a bamboo we succeeded in hauling out the bird. There was a breathless moment before daylight showed it to be the longed-for but only half-anticipated cahow! Its egg could then be seen in the nest.

Our almost unbelievable captive bit the hands that grasped it but only half-heartedly. Within a moment it became completely unresistant, allowing itself to be stroked, tickled, and passed from hand to hand. We banded and photographed it and jotted down hasty descriptions of its flesh colors, including the pink feet. When put on the ground, it scurried back to its egg. During the whole period of badgering, extraction, and handling, it had neither uttered a sound nor ejected oil from the throat or nostrils. The last point is noteworthy. No cahow handled during our visit spewed out stomach oil in the reaction that is so common among petrels. All the birds remained docile, dry, and fluffy, as well as practically devoid of odor.

Our little islet, like Cooper's Island itself, had evidently fallen within the wartime target area. Its top was peppered with green, corroded, and distorted bullets of small arms. So far as could be judged, this had had no deterrent effect upon the return of the cahows. Even more remarkable, perhaps, the petrels still come back seasonally to their ancestral homes despite the glare of beacons on the near-by airfield and the close roar of planes.

Our next step was to stand watch on islet "A" through the night of January 29. The swell was high in Castle Roads, and the ocean still rougher off Gurnet Rock and outside the boiling skerries, but we found quieter waters when we passed through a gap in the reef just east of Cooper's Island. We landed from our skiff on a convenient ledge, and the launch was sent back to the Aquarium.

With the aid of a seven-foot ladder, we transported our gear over a miniature precipice to the top of the islet. For the early evening all hands stationed themselves beside the gully leading to the first cahow's nest. Later we spread out over the islet so as to keep as many nests as possible under observation. At 52 minutes after sunset, the luminous worms known as *Odontosyllis* came to the surface below our perch and made a grand star-blue display in the water. Sirius was shining at the time, and the lights of the worms were considerably bluer than that star. Louis reported that the essential degree of darkness for the creatures usually comes at precisely 52 minutes after the sun has gone down and that the sparkling continues for about 20 minutes.

After dark, the revolving signals of Kindley Field periodically touched the summit of our islet with faint gleams. As soon as the sky had lost all trace of afterglow, we began to see swift silhouettes of birds overhead and from time to time to hear single, soft *screepy* notes. At 8:32 P.M., a cahow fluttered above our huddled forms on the ledge, passing several times back and forth in front of the niche. Then it dropped silently into the entrance. Three torches were turned upon it, and the bird was picked up. We all examined it, then put it down. It walked unhurriedly into the burrow, carrying its wings slightly spread and drooped.

Shortly after nine o'clock, a group of cahows flitted about, glimpsed in a twinkling against the dark sky. Our watchers had by this time dispersed to their several stations. Each member saw birds, and David, the youngest, heard the single, soft note more often than the rest of us. It was impracticable to estimate the number of cahows in flight because they all scouted to and fro briefly before coming down.

We two clung to our uncomfortable ridge and continued to watch. The clouds presently began to close in from the southwest. Orion and the Great Bear first became hazy and filtered-looking and then were blotted out. The water swirled and

Continued on page 189

CHIAPAS—A Naturalist's Paradise

Explore the matted jungles of southernmost Mexico—an exotic wonderland where size is king and variety challenges the imagination

By ARTHUR STANLEY RIGGS

A VAST wonderland for the naturalist lies to the south of us where once the Mayas roamed. Of good roads there is not one in all that tremendous expanse of jungle and mountain ranges. The brawling, dangerous rivers and a few matted, almost invisible old trails are the only communications. Travel is difficult at best, and he who goes exploring there must be tough and willing to live largely off the country.

This region is the State of Chiapas in southern Mexico, bordering the Republic of Guatemala on the east and touching the Pacific Ocean on the south. Its rich soil, humid heat, and network of swift rivers have developed a plant and animal life of astonishing variety. So prolific is nature that the Indians, when they want a few vanilla beans, do not bother to save the vine but cut it down, along with the small tree around which it twines, and pick the huge pods without having to stretch or climb. And the mahogany we consider so valuable is used here for posts and palings or to stoke the kitchen range in ranch houses.

Two main objects sent me to Chiapas: a deep interest in Mayan culture and its remains, and—for the moment more pressing—the

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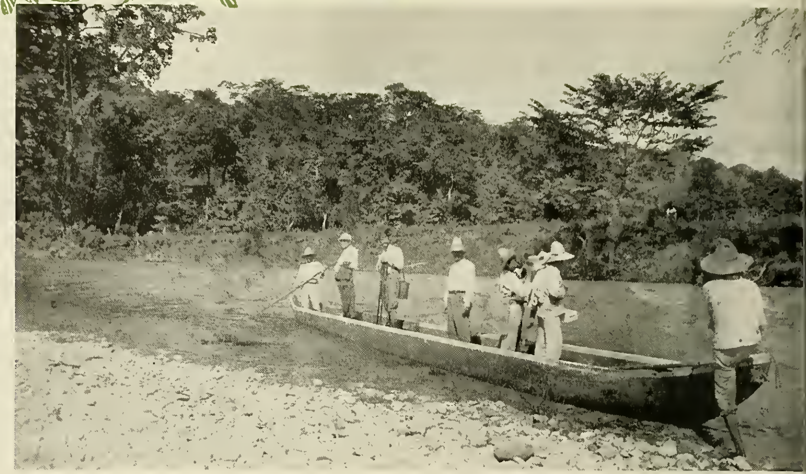
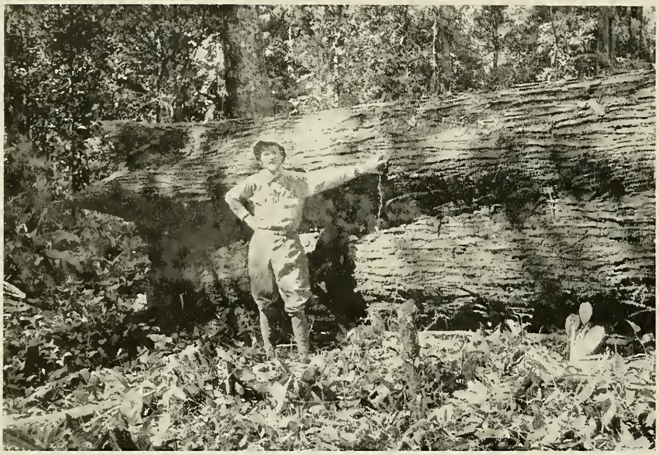
➤ ONE TYPE OF TROPICAL BOAT: lumbermen poling up the Usumazinta River in Chiapas

➤ A LARGE canoe used by the author in exploring parts of Chiapas—a boat 49 feet long and 41 inches wide. It had a 12-inch runway topping the gunwale for the Indian polers



Don Rubén photo

▼ THE AUTHOR beside a mahogany cut for his benefit —a tree described as relatively small. It measured 7 feet in diameter at the butt and 92 feet high



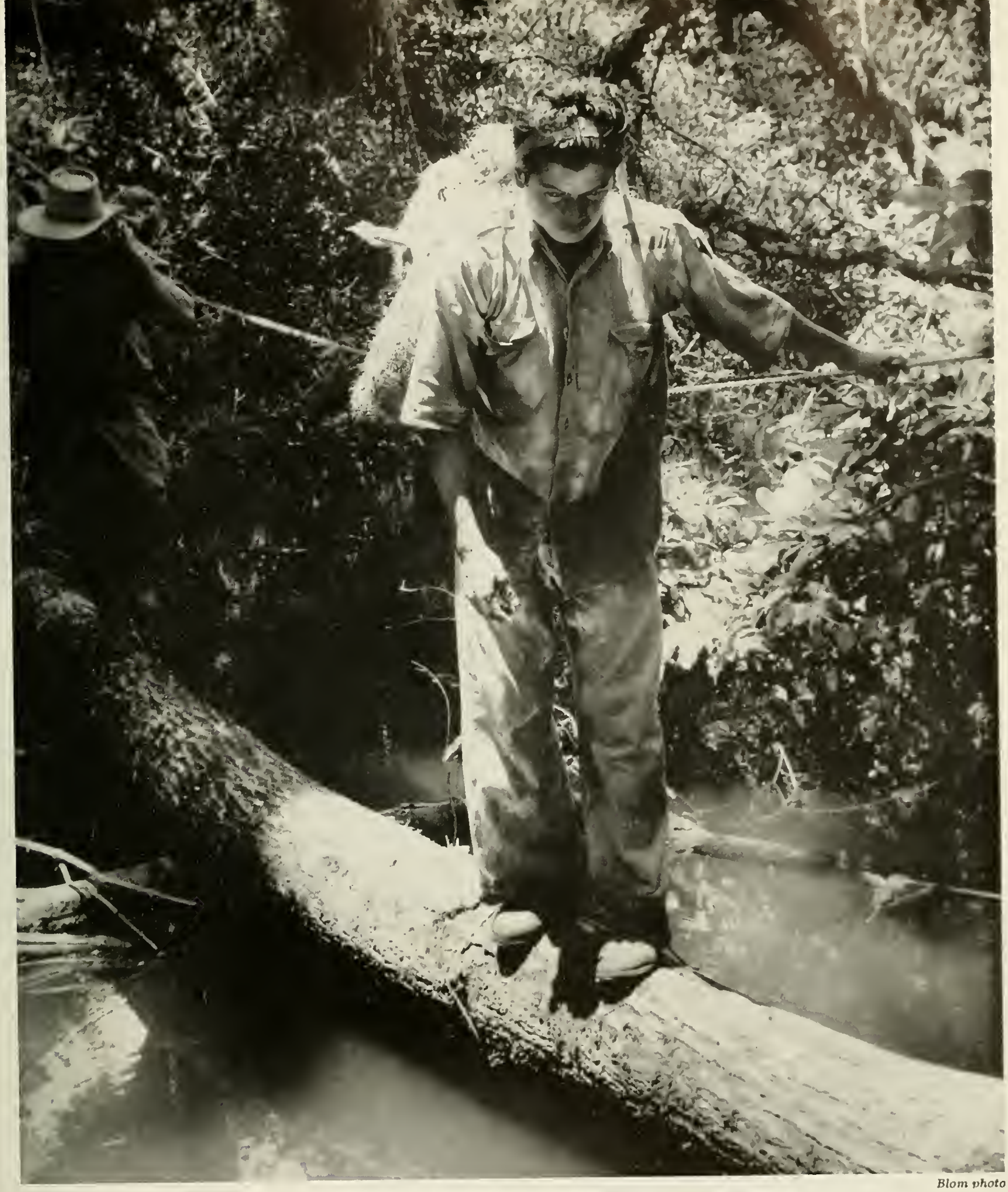
Don Rubén photo

▼ IN THE FINE NURSERY of Rancho Encanto, hundreds of young mahogany trees were grown from selected seeds. They are permanently replanted, about four to six to the acre

Arthur Stanley Riggs photo

need to inspect what was said to be an unusual stand of mahogany, *chico sapote,* and other trees of marketable timber. As dendrology is not my field, I had to rely for names and data upon the native Indians and upon the kindly superintendent of the Encanto Ranch, a German of long experience in the tropics and so respected by the Indians that he could go anywhere in perfect safety. The Lacandone Indians had given him the nickname Tata Mamal, or "Little Mister Grandfather," by which he was known far and wide. Thanks to his wise and patient guidance, exploration was possible with fewer difficulties than had been anticipated.

The one thing completely overlooked was the temperature of the water for developing and washing films—averaging about 89 degrees F.—and the difficulty of drying the emulsion thoroughly in the prevailing humidity. The river water was clear and cool, tests showing it to average about 68 degrees F. So the first rolls were joyfully set to wash in the swift current. The results were disastrous, for the water carried invisible sharp grains of sand or grit, and the negatives looked as if they had been peppered with shotgun blasts. Then a real washing tray, to be mesh-screened and set in the river, was built of the finest straight-grain

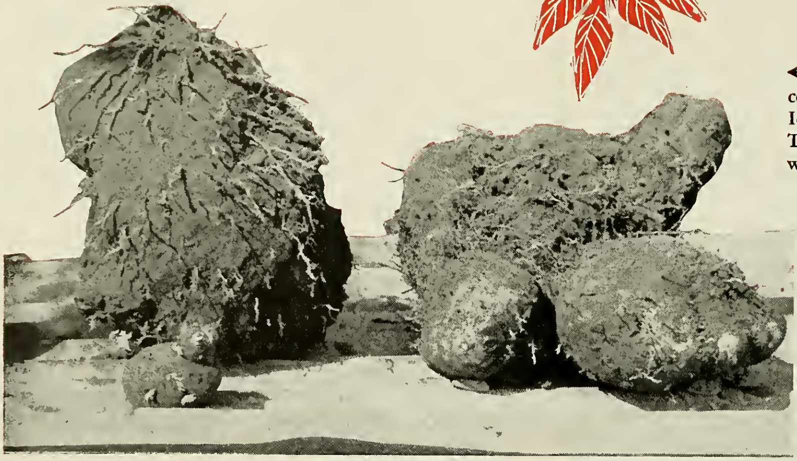


Blom photo

▲ A NATIVE PORTER crossing a river in Chiapas

mahogany and set out to "bleed clean." It "bled" for three full days, the dried sap dissolving in a strong current that stained the river pink for yards. If we would believe a myth that is fairly widespread in Latin America, that particular mahogany must have been felled when the moon was waxing, drawing sap up into the wood. Though there is no scientific proof for this belief, woodsmen in the jungle are apt to wait to fell a tree until the waning moon has had an opportunity to draw back the sap. This is so that the wood will dry more quickly and thoroughly and show less tendency to warp and split.

Rancho Encanto is situated about 20 miles west of Palenque. Its broad acres of woodland and jungle, its pasture for the ranch cattle, and its brawling streams for power and light, include typical representatives of every form of life. The big, sprawling ranch house, the store and commissary, and a few outbuildings top a low hill sloping down through pleasant meadows to the little Encanto River. A first experience with what Chiapas can produce was forthcoming the day



◂ A 32½-POUND *batata* compared with a good-sized Idaho potato at front left. The smaller *batata* at right weighed over 19 pounds

Arthur Stanley Riggs photos

▾ ORANGES as big as grapefruit, and "rough lemons" almost as large

after my arrival. Amalia, the Indian cook, told Pedro, one of the boys about the place, to bring her in enough *batata* for dinner. "We feed eighteen," she said.

Half an hour later the boy came back, less than a quarter of one "potato" in one arm, a generous load of split mahogany firewood for the stove in the other. The cook scowled at him.

"Bribón!" she snarled. *"Que estupidez!* [You stupid rascal!] I told you for eighteen. You bring enough for twenty-five!"

Pedro squatted on his haunches, unmoved. "Well, there are the pigs."

Idaho potatoes were the largest I had ever seen, but they seemed like pills beside these hairy-rooted monsters, some of which have been known to weigh up to 35 or 40 pounds. From the true botanical standpoint they are not potatoes at all as we know them but a species of yam (*Dioscorea*). Nevertheless, call them by whatever name one will, they boil, mash, fry, and dice with a pleasing flavor and have a food value that is nothing to sneer at.

Huge as the *batatas* are, they are merely a scale in miniature for measuring other growths. Perhaps 100 feet from the ranch house towered a lofty and beautiful cedar tree, with a royal palm looking like a dwarf beside it. So huge was this tree that when Don Manuel, the Spanish-Indian assistant to the Superintendent, sat astride his big donkey "Saltador"—"Jumper," because he always bucked when saddled—the trunk of the tree extended beyond the animal's head and tail.

No one can explore such a region day after day and week after week without being filled with wonder at the prodigality of nature. Every riverbank for miles is lined with huge reeds looking much like sugar cane and growing to a height of ten feet or more. But this *caña brava* (*Gynerium sagittatum*, as it is scientifically called) is almost pure cellulose. Yuccas grow to astonishing heights and rare beauty. Spiny plants of myriad types, mostly species of *Agave*, provide fibers for cordage. When twisted, they make a rope so hard and stiff that it is almost like wire. Oranges six and seven inches in diameter are common, and "rough lemons" grow almost as large. One tree of unusual beauty and ordinary size is the *achiote—Bixa orellana*, of the Annatto family. A reddish-orange stain is obtained from the arils that cover the seed in the capsule. This coloring agent is reported to have been used by the Mayas for painting their pottery.

But for color, it is the orchid that outshines every other plant in the tropics. We are accustomed only to florists' oversized hybrids, often monotonous in form and color. Besides the river leading south from Salto de Agua to the Encanto River is an old Maya trail six miles long, bordered by forest giants from whose trunks and arms sprout probably a billion or two orchids. Green orchids, yellow orchids; pink-black-green, brown, and purple-saffron-white ones; orchids of every imaginable shade and tint burst from their supporting trees by the cubic yard. They turn the archway of the branches into a weird devil's tapestry of color and shape. Not a flower in the vast array is bigger than a small pea; most of them are smaller, but each is perfectly formed and of rare beauty when examined closely. But en masse they gave me the shivers by their terrific color and repulsive shape.

At the edges of the trail there occasionally rises a straight, slim tree about ten feet high. If you are absorbed in the flowers above, your donkey will gently brush you into this devastating monster. You shriek with pain as its thorns cut through leather legging or boot, and unless the greatest care is taken to prevent infection, serious results follow. Nobody notices the thorns at first. They are flat, double-edged, steel-hard, razor-sharp, shaped exactly like knife blades. They spiral around the bole of the tree screwlike, in regular twists about two inches apart. Tata Mamal's mount brushed him into one, despite his seventeen years' experience in the region. His stout leather legging was cut through, the thorn ran two inches under his kneecap, and he was bedridden for days.

Another reason for high boots or leggings is the snakes. Most of them are harmless, but some are deadly, and as they are more or less provided with protective coloration, they may strike before they are seen. Curiously enough, the barefooted Indians seem to suffer very little from them.

With all the wonders of the jungle crowding about, big trees have to be more than merely large to fix attention. I had seen huge forest monsters in the *bosque* in the Philippines, in Ceylon, and in the Straits Settlements, and I knew something of the ways of the jungle and its conditions. But never anywhere else had I beheld such a seemingly inexhaustible parade of majesty, beauty, rarity, and utility in one region. Of all the different species, the *Swietenia macrophylla* and the *Cedrela mexicana* are the most beautiful, interesting, and commercially useful.

The growth habits of these two great trees are interesting. Both trees are found in very small stands, usually not more than three or four to an acre. The older and larger specimens tower up to as much as 150 feet, with buttresses growing radially 20 or 30 feet from the main trunk and their branches spreading 50 to 60 feet on every side; so it is easy to see why so much space is required. At their feet the jungle sends up thousands of small trees, a matwork of vines, and lush small growth of a thousand sorts. Underfoot the soil is many feet deep in pure humus—the rotted leaves and seeds of untold ages—and in the gloomy atmosphere near the forest floor there is the reeking odor of decaying organic matter. Here and there rises a tremendous mound, often with a great tree crowning its top.

Not infrequently these mounds prove to be the ruins of Mayan structures, swallowed by the jungle and now merely the rooting places of trees much more permanent than the civilization they replaced. The Indians believe treasure is buried in each of these big ruins, and it requires little urging to get them to scrape away the detritus of the ages to uncover intricately carved stones, often rising pyramid-fashion in steps. Scores of such mounds exist on Rancho Encanto, but for various reasons they have never been thoroughly investigated by trained archaeologists.

Shipment of mahogany and many of the other varieties used by cabinetmakers is very arduous and time-consuming, so their effect on the general hardwood market is limited. Practically every river in Chiapas at some point in its course has a *salto* or fall—really a series of abrupt rapids—with a maximum descent of anywhere from a foot or so to perhaps ten feet at low water. The battering the logs get going through the rapids often results in serious splitting of the butt ends, with consequent loss. The answer to that problem, of course, is the importation of big caterpillar tractors with trailer trucks, pre-

▼ AT THE FOOT of a tremendous *Tinco* tree. It is about 125 feet high and 12 feet 4 inches in diameter a yard above the ground. *Tinco* wood is very heavy, iron hard, and difficult to work

Arthur Stanley Riggs photo

ceded by bulldozers to clear paths through the jungle to deep water. As that is expensive and recovery of the initial investment requires considerable time, the trickle of mahogany, satinwood, cedar, and other fine woods to the American market will probably remain small for a long time.

Mahogany is propagated by seeds that are contained in small, pear-shaped capsules, and each seed has a gauzy wing. The capsules open while still on the tree, and the seeds are scattered by the wind. Boys are sometimes sent up the trees just before the capsules would naturally open to collect them for nursery planting. They drop the capsules to assistants on the ground, who open them with machetes and remove the seed. The seeds are planted in nursery beds, and the young mahoganies are transplanted before the root system becomes too extensive. Plantation mahogany has never done as well, however, as might be hoped, partly because the nursery trees are severely attacked by the twig borer, *Hypsiphyla grandella*. It causes the tree to assume an "apple tree" form instead of having a strong central trunk.

Once the logs have been sawed into planks, the layman can distin-

Arthur Stanley Riggs photos

▲ A CEDAR TREE rising 75 feet to the crotch. It was about $11\frac{1}{2}$ feet in diameter 3 feet above the ground

➤ DON RUBÉN'S MULE was several feet shorter than the width of this giant cedar

◀ THREE LACANDONES on a "bridge" in the forests of Chiapas

Copyright by Gertrudis Duby

▼ LACANDONES making bows of Guayacan wood in front of a chicle tree in the forests of Chiapas

Copyright by Blom-Duby

guish between cedar and mahogany by the fragrant smell and pungent flavor of the cedar. The cedar is also softer, slightly coarser in texture, and even more brittle than the mahogany. Both woods are easily worked and very durable. They take stain and polish and are adaptable to many purposes, and both bring a high price in today's world markets. Those two trees, though the best known of the tropical hardwoods, are by no means the only useful ones. The *chico sapote* (*Achras sapota*) is an extremely heavy wood, almost iron-hard and reddish or reddish-brown, unless a superficial fungus has made it purple, and it makes indestructible railroad ties, foundation pillars for houses, pilings, and other heavy construction necessities. *Tinco* is so hard it is like metal, but it has a remarkable grain, fine markings, and takes a mirror-like polish. It is also a dark color. Its opposite is the *palo maría* (*Calophyllum brasiliense* Camb.), not the same as the reddish *palo maría* or *Calophyllum inophyllum* of the Philippines. The Mexican tree to which we refer is yellow and, like some other tropical woods, may contain fungal stains caused by stored concentrations of starches and sugars. It is conceivable that modern furniture manufacturers, who have run so toward "blonde" dressers and chests, would find this a most interesting material for futuristic designs. Besides these, there are many others, for we have not yet scratched the surface of the jungle's manifold resources.

I want to go back to Chiapas, in spite of the corns I grew on my hipbones from sitting on the hard bottoms of mahogany canoes over more than 500 miles of turbulent rivers; in spite of the six-inch scorpion that fell with a splash into the basin in which I was about to wash my face one morning; in spite of the heat and the humidity, the stinging black gnats, the *sábalos* that leaped into our canoes from the river and tried to bite us. For there are hollow trees in the dim recesses of the jungle stuffed with 50-pound caches of honey perfumed by exotic tropical blossoms; there are oranges and grapefruits one can "swim in"; there are big *tigres*—jaguars—that steal pigs literally from your doorstep at night. There are waddling turtles that lay eggs on the riverbanks while fiery-hued macaws scream at them. Yes, and roasted armadillo tastes every much like sweet young chicken-flavored pork. Chiapas . . . naturalist's paradise.

friend Lobster is food for thought

By
N. J. Berrill
McGill University

"AND towards night we drew with a small net of twenty fathoms very nigh the shore; we got about thirty very good and great lobsters . . . which I omit not to report, because it sheweth how great a profit the fishing would be . . ." So wrote Waymouth in the journal of his voyage to the coast of Maine in 1605.

Three and a half centuries later the Maine lobster fishing is still good, though the days of the "great" lobster are gone. Intensive fishing and close regulation, in effect for many years now, have prevented all but a very few lobsters from reaching any great age or size. I have risen before dawn and been out with the lobstermen, and it is seldom that a string of their traps will get them a catch with more than half the lobsters in it of legal size or over. But big lobsters or small, state regulations and canny down-East shrewdness have kept the Maine lobster industry in a robust condi-

Ewing Galloway photo

▲ **Served in proper style:** caught yesterday, flown to market, and cooked today —the favorite dish of many Americans, inland as well as along the seacoast

He may look clumsy and unresourceful, but can *you* put new sand in your balancing organs when they become empty?

tion, whereas neighboring Massachusetts caught and ate up their local supply long before the Civil War. Nonresidents of Maine were prohibited from catching lobsters as early as 1823, and though I can sit on a rock at the end of my own Lobster Cove near Boothbay Harbor and call it my own, I cannot set a trap and I cannot touch the lobster buoy within reach of my hand—I'm a summer resident.

Lobsters took a beating when canning them was in vogue. There was a nine-inch law that tried to save them, but nine inches barely permits a lobster to grow big enough to produce eggs; and the industry, as usual, was trying its best to commit suicide by carefully avoiding the slightest pretext at conservation.

The ten-and-a-half-inch law, passed in 1895, produced a revolution. Lobster canning folded up overnight, lobsters spawned in increasing numbers, and the fresh-lobster industry began a boom that today has about 6000 lobstermen fishing up and selling as many as 19 million pounds of lobsters in a year. That is, about 17 million lobsters were caught during the best year in the last decade. The State began an annual purchase of from 20,000 to 40,000 seeders, or egg-bearing lobsters, for planting and several thousand more for hatcheries. The importance of this is simple: a lobster in its first egg-laying season carries 9000 to 10,000 eggs, but if it lives long enough, it may carry as many as 100,000 at a time. So protection is given not only to young adults but to older lobsters if they have stayed out of the traps for a few years more. They have then become too valuable as egg-layers for anyone to be permitted to catch and sell them. In other words, it pays to let the older ladies live.

* * *

Age and growth do queer things to a lobster. Claws and body grow at different rates, and in a very small lobster the claws are hardly worth the picking. The larger the lobster grows, the larger grow the claws, not at the same rate but faster, until at last, in those giants you sometimes see in public aquaria but never in the fish market, the unbelievable happens and the tail wags the dog. The giant of them all was a lobster that weighed *thirty-five pounds*, as heavy as a child in a nursery school, with claws alone weighing more than two-thirds of the total. It is a wonder that a lobster can feed itself with such cumbersome weights to lift, though when an animal lives in water, its weight is only the difference between its weight in air and the weight of the same volume of water. All the same, such a lobster is quite a sight, a lumbering tank that moves slowly and no more than it must, which is not much.

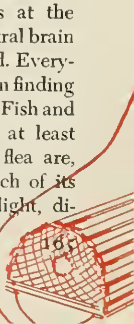
Freshly-caught lobsters do not always go straight to market. Most lobstermen keep a small "live-car" afloat near their moorings, and the tidal pounds up and down the Maine coast can keep about five million lobsters more or less happily waiting for the right price. They are fed mussels, though the lobsters do what they can to supplement the monotony by digging, shucking, and eating the clams generally found in the muddy bottoms of the pounds. The idea of impounding lobsters behind a barrier that lets the greater part of the tide in and out but holds the lobsters behind bars is by no means new. The French took such matters seriously long before the rest of us. I remember a visit to a famous marine biological research laboratory at Roscoff on the north coast of Brittany, where ancient lobster pounds were operated by the town and hundreds of thousands of lobsters awaited the Paris market.

On this continent, along the middle and east Atlantic coast, you get the American Lobster, with its great claws. The Spiny Lobsters of several sorts, all much the same, are found throughout the tropical waters as well as in the Southern Hemisphere and along our Pacific and southern shores. In Europe, besides Spiny Lobsters, you find the quite different little Norway Lobster and also the *homard* of the French gourmet, which is very similar to the American Lobster. In that little French town, I had them all, one after the other or all at once—the Norwegians piled high like shrimps, the Spiny ones as stew, and the *homards* as straight lobster. But it was the heavy, brittle shell of a Norway Lobster that cut my finger to the bone, and I know those lobsters by sight, smell, and taste and by touch and pain.

The table is no place, of course, to study what food was like when it was alive. But if you are tough-minded or can get a lobster onto your lap before it gets into the pot, it is worth-while looking at it for what it is—a marvelously-fitted piece of machinery designed for living.

We are inclined to take our commonplaces for granted. A lobster has a front and a back end, eyes, a heart, and some kind of a brain. "Naturally," you might say, yet it's not "naturally." A starfish or a jellyfish has none of these. The shape of a lobster means that it goes forward or backward but not sideways like a crab. Primarily, it is built for moving forward. But the shape of the body (streamlined toward the tail), the powerful muscles of the tail itself, and the broad fan at the end of the tail are all directed toward fast, sudden movement to the *rear* as a means of escape.

The place for the pilot of a ship or a plane is on the bridge or in the cockpit. A lobster or a fish has its navigating instruments at the front end, too, with the central brain control immediately behind. Everything is in pairs, for direction finding and for operational control. Fish and lobsters are not relatives, at least no more than you and a flea are, and yet each has eyes, each of its own kind, for supplying light, di-



▲ A Maine lobster fisherman, setting off in early morning to haul trap line

Three Lions photo

▲ Lobsters are trapped in "pots" like this, which rest on the bottom and are located by floats

◀ A female seed lobster with eggs under the tail at the incubation stage

▼ Fifth stage or fifteen-day-old lobsters from the Rearing Station at Boothbay Harbor. At each stage the lobster sheds and grows a new shell. Even a 35-pound lobster once looked like this

Photos from the Dept. of Sea and Shore Fisheries on the Maine Development Commission

rection, and images. Each can touch, smell, and taste—an intimate contact with the watery world without. And both respond to gravity.

Most animals that swim, run, or fly have what seem to be gravity organs, all very much alike—small sacs of sensory tissue enclosing little heavy stones that shift about as the animals move. Lobsters and their tribe have a pair of sacs that appear to serve the same purpose. But they are unusual. They are not closed sacs but are depressions of the outer surface of the body; and instead of growing its own stones, or weights, the lobster picks up sand grains from the bottom and places them in the cavities.

Surely these organs looked like gravity instruments, but appearances can be deceptive, and biologists have to be careful in their deductions. Fortunately, experimental proof was possible.

A lobster sheds its skin periodically. This includes more than you would think—not merely the shell or skin of the outer body, claws, and legs but the lining of the stomach and intestine and the lining of these balancer sacs. Whenever this happens, the soft-shelled lobster has to insert a fresh supply of sand grains to replace those lost with the old skin.

The information that these organs are for balance is more than guesswork and comes from a trick someone once played on the lobster's relative, the prawn. The trick was obvious enough when you read about it but a stroke of genius at the time. Iron filings were made available in place of sand. The prawn put some into its sacs without knowing the difference, and apart from inevitable rusting, I imagine it would have gotten along perfectly well. But iron filings respond to a magnet whereas sand does not, and the pull of a magnet is like the pull of the earth. A mag-

Three Lions photo

▲ **One claw** is a crusher and the other a cutter. The crusher is more often on the right; but sometimes you see a "south paw," as shown here

net was held over the head of the prawn, which was swimming through the open water where it could not orient itself by its other senses. The filings flew up toward the magnet and pressed against the part of the sacs normally stimulated only when the creature was upside down. It reacted according to information received and proceeded to turn over. It did not turn clear over because the magnet did not completely mask the effect of gravity, and the prawn responded to the resultant of the two forces.

Look for a moment (if the lobster is still on your lap) at its lower side. The animal has five pairs of "legs," four of which are used for locomotion. The other pair has evolved into enlarged claws for feeding. And please notice that one claw has become a crusher and the other a cutter, as though to prove that a knife and fork are better than two knives. Even after the food has been cut up into small pieces, the lobster handles it in a most delicate way, using as many as six pairs of jaws or jaw accessories to get it into the narrow gullet. More than that, when the food does reach the stomach, the gastric mill, with its teeth, rods, and muscles, grinds it up with the digestive juices.

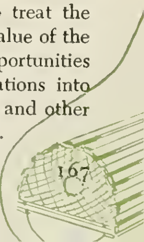
So much for food; what about oxygen? Blue blood needs oxygen as much as red, and gets it through the gills. These are cream-colored, feathery structures hidden from view beneath the armor at the sides of the body, and water is bailed through them continuously. These gills have an interest quite apart from their respiratory function. Each grows from the base of a leg, and each leg unit is a double feature, one branch for breathing and another for walking. It is as if your shoulder muscles operated not only your arms but a pair of wings you may be hoping to sprout one day. The image that comes first to my mind is of a one-man band I saw not long ago, with hands and forearms working an accordion, and drumsticks fastened to the elbows beating a drum on the man's back.

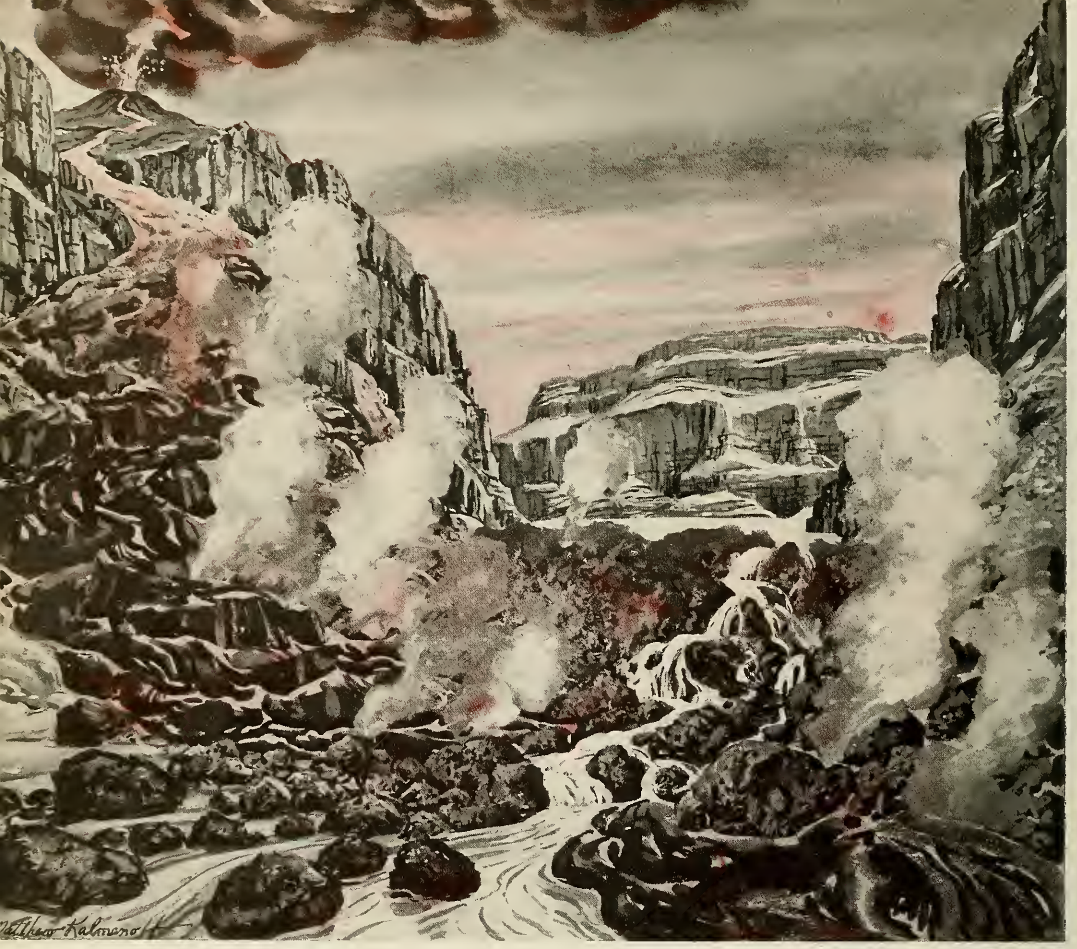
Double duty seems to be a lobster commonplace. The appendages beneath the tail have different things to do at different times. They are called swimmerets, which tells something about them. When a lobster wants to move forward when its legs are off the sea floor, the swimmerets paddle in a regular rhythm and the animal actually swims. This is their main purpose, but another use has crept in. When it comes time to spawn, the eggs are fertilized with sperm stored for anything from a few minutes to two years in pockets behind the legs. Then the eggs are glued to the swimmerets, and there they stay until they hatch, rocked gently in the water for the best part of a year. It seems a long time for such a small egg to develop, but for much of the time little actually goes on. There is a quick start during the first summer, then a slowing of development almost to a complete stop as the sea temperature falls with the bitter cold of the North Atlantic winter. When warmth returns (if you can call it that), development speeds up to a quick finish, and the young lobsters hatch in water already teeming with the microscopic life they need as food.

For many years the "berried" lobsters have been kept in hatcheries and the larvae reared in tanks at relatively warm temperatures. The idea is to rear them through the free-swimming stages, or that part of their life that is subject to the greatest dangers. It is a tricky procedure and very much like raising fish fry. The larvae are usually kept in the tanks on a diet of ground beef and liver or ground fresh mussels, until most of them cast their skins for the third time, when they are called fourth-stage larvae. At this stage, for the first time, they look less like small pollywogs and more like small lobsters. It is about as far as they can be raised by artificial means, and they are just about ready to seek the sea floor and comparative safety.

But what effect the large-scale plantings of lobster larvae have had through the years is difficult to say. In all probability, it is very little compared with the effect of good restrictive regulation of the lobster industry. For in every alternate year, an 8-inch lobster produces an average of about 5000 eggs, a 10-inch lobster about 10,000 eggs, a 12-inch one 20,000 and a 14-inch lobster an average of about 40,000.

Nature, man excluded, does pretty well when left alone, and while hatcheries do compensate for overfishing to some extent, it is better to cure the evil than to treat the symptoms. The greater value of the hatcheries lies in the opportunities they afford for investigations into the life history, diseases, and other things we need to know.





Drawing by Matthew Kalmenoff

Where Lava DAMMED THE COLORADO

Near the most breath-taking view in the Grand Canyon, the vacationist can see where a mighty cataclysm once challenged the world's most imposing river

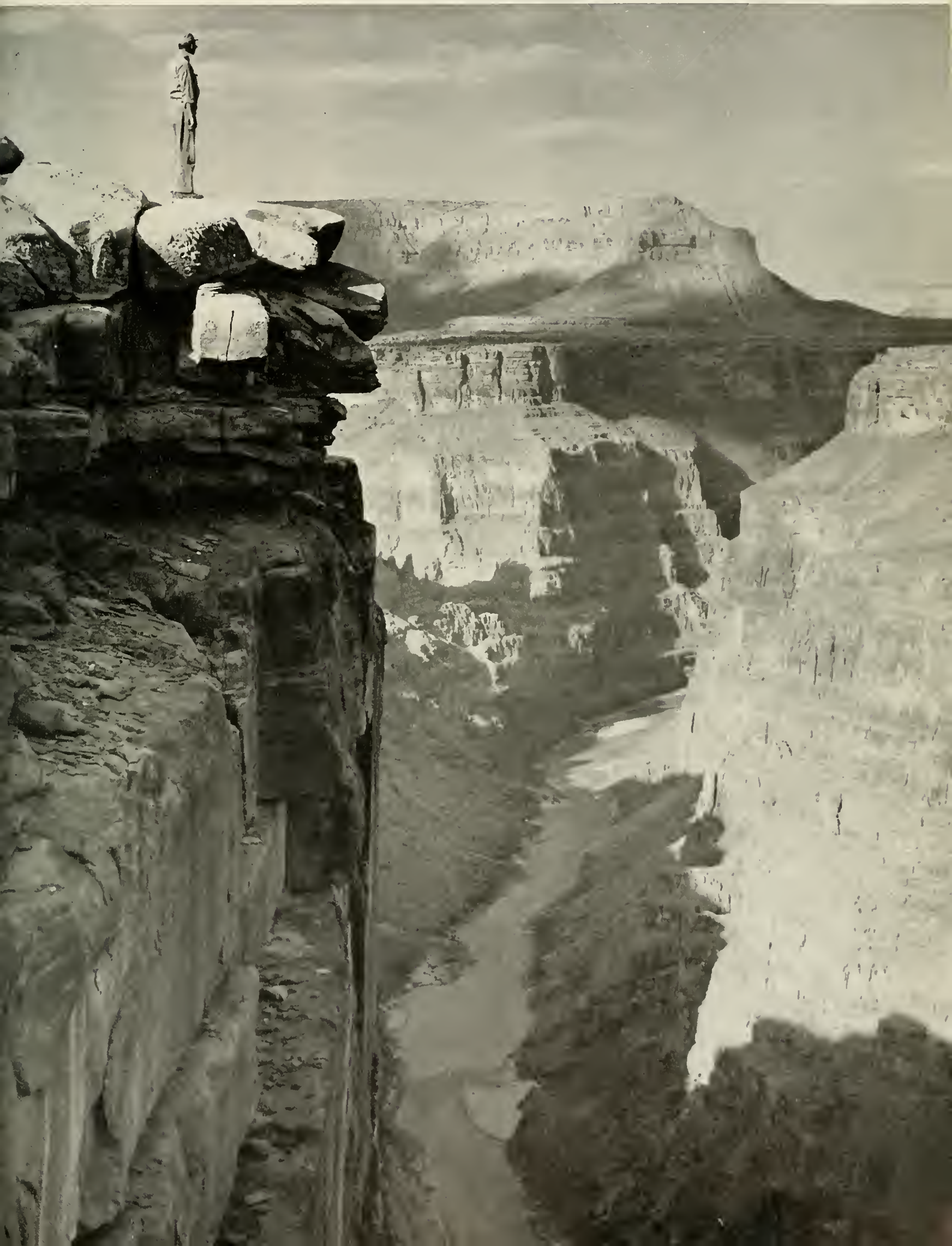
By Philip Ferry

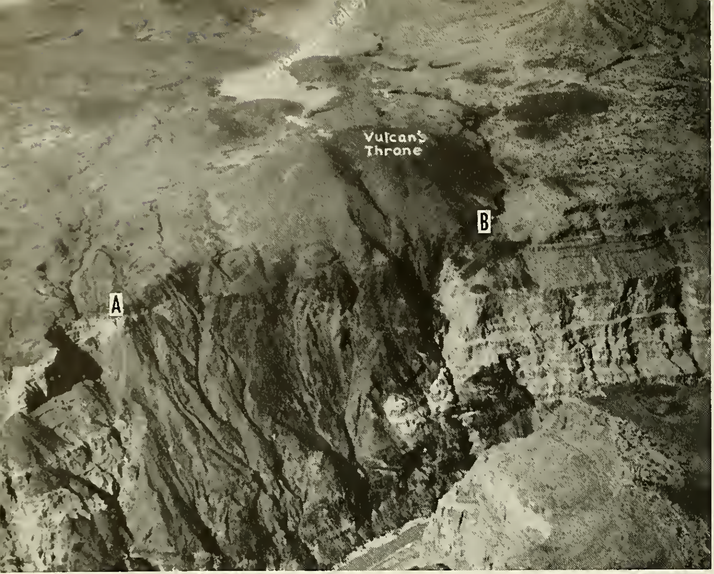
THE whole world knows about Grand Canyon National Park and its prize exhibit, the Grand Canyon of the Colorado River. Only a small segment of the world's population has heard of Grand Canyon National Monument, which adjoins the Park on the west. The two form a continuous natural preserve which borders on 100 miles of the famed canyon. Together with the Lake Mead National Recreational Area, which bounds the Monument on the west, they comprise a 200-mile strip of federally-administered national playland.

On most maps the Park and Monument appear as one. Actually, the Colorado River divides the two, with the greater part of the Park south of the river and most of the Monument on the North Rim of the great gorge. Because of its geographical position, the Monument offers a unique perspective of the

▼ 3000 FEET STRAIGHT DOWN: Toroweap Point, overlooking the Inner Gorge of the Grand Canyon. This is the most sensational view point in the entire Grand Canyon system. A strong pitcher can hurl a rock into the river—but don't swing too near the edge!

Alfred Schmitz photo




Vulcan's Throne
B
A

canyon that is known to only the most seasoned desert travelers.

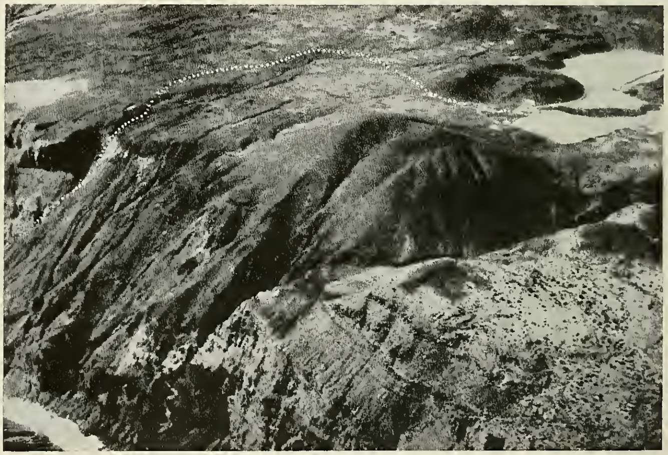
Toroweap Point (pronounced Tor-o-weep) is the ultimate in scenic spots, but up to the present it has remained almost a legendary place. The condition of the road has kept all but a few motorists from hazarding a visit. This circumstance need no longer be a deterrent. True, the final six miles, from Toroweap Ranger Station to Toroweap Point, would be impassable in rain, but a car with a high ground clearance is perfectly safe in dry weather.

Our suburban carryall, with its high clearance, heavy-duty tires, and truck transmission, encountered no difficulties whatever, although we found the road exceedingly

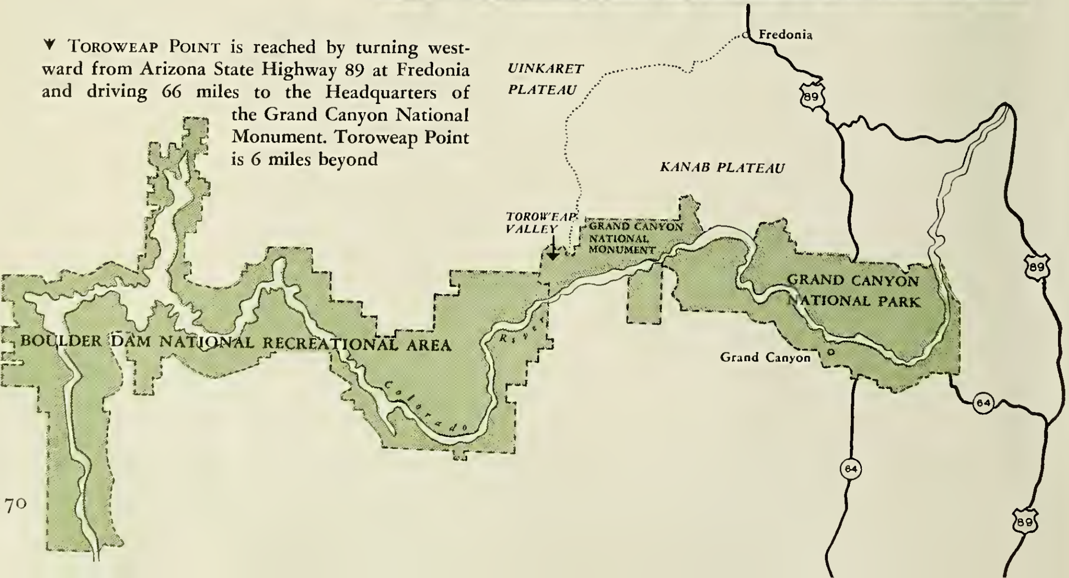
Photos by John H. Maxson

▲ An aerial view looking northward across the Grand Canyon. Molten lava, flowing through Toroweap Valley (then a gorge), poured into the Grand Canyon between points A and B to produce what is now called Toroweap Cascade. The 600-foot dam was in time erased by the Colorado River

➤ From the southeast, with Vulcan's Throne in the center: an aerial photograph showing the route the author's party took from dry lake in Toroweap Valley, across the lava field, and down Toroweap Cascade to the Colorado River



▼ Toroweap Point is reached by turning westward from Arizona State Highway 89 at Fredonia and driving 66 miles to the Headquarters of the Grand Canyon National Monument. Toroweap Point is 6 miles beyond


Fredonia
UINKARET PLATEAU
89
KANAB PLATEAU
TOROWEAP VALLEY
GRAND CANYON NATIONAL MONUMENT
GRAND CANYON NATIONAL PARK
89
BOULDER DAM NATIONAL RECREATIONAL AREA
River
Colorado
Grand Canyon
64
64
89

dusty. Also, it was barricaded at intervals by closed cattle gates that required individual opening and shutting. It is only the last six miles that would stop a low-slung car. Technically, this section is not a road but a pair of primitive wheel tracks. However, the motorist who has gone this far is not likely to be turned back by this typical bit of unimproved desert road. Certainly the rewards at the end justify the undertaking. Our party of three—which included Alfred Schmitz, photographer, his wife Virginia, and me—felt amply compensated when we visited Toroweap in May of 1950.

Toroweap Point perches spectacularly on the brink of the Colorado River's Inner Gorge. This is the sheerest part of the Grand Canyon and the section where the two rims come closest together. From the Point, the spellbound spectator looks down 3,000 feet to the waters of the Colorado and gasps at a view that is surely one of the most spine-tingling in all the world. Here the great Colorado, heavy with its burden of mud and silt, looks motionless, except for the distant rapids of Lava Falls. Oddly enough, it is difficult to determine just what makes the sight so spectacular. Toroweap Valley is only 3,000 feet above the river, and there are other spots along the two rims where the canyon is much deeper. But it is a fact that the view from Toroweap Point is one to send a thrill through even the most casual observer. Virginia's comment, after a single glance into the abyss, was terse but descriptive.

"It scares the breath out of me."

Lon Garrison, Assistant Superintendent of Grand Canyon National Park, believes it is the sheerness of the walls that creates the illusion of excessive height. Elsewhere along the two rims, the view is across a series of sunken plateaus and mesas. Here one looks directly down into the river. Garrison points out that a person with a strong throwing arm can cast a stone far enough out from the rim to clear the canyon wall and reach the river below.

At the Point, one is conscious of a powerful updraft surging from the canyon. Birds utilize these air currents to go zooming over the Point. They sail overhead like ghost wraiths, the swishing of their bodies plainly audible though the birds themselves are often moving too swiftly to be seen. Cliff swallows, ravens, the melodious house finches, mockingbirds, and two species of hummingbirds can be seen in the area. Most of them, except the leisurely-soaring raven, sail over the mesa like jet projectiles, singing and

▼ **Toroweap Cascade** is the black mass of lava beyond the standing figure. It drops 3000 feet from the floor of Toroweap Valley to the canyon bottom

Photo by Alfred Schmitz

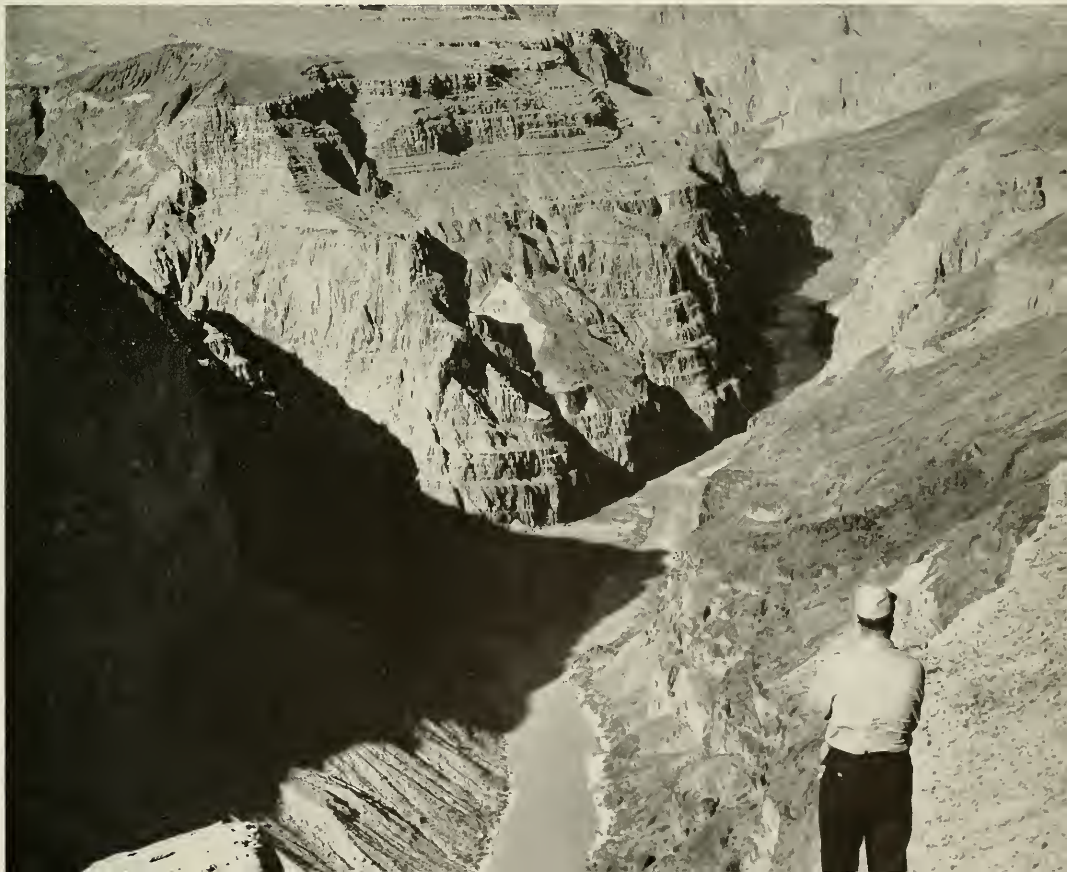


Photo by Alfred Schmitz

▲ VIEW from Kanab Point, another spot on the North Rim. A small stretch of the muddy Colorado is seen in the bottom of the canyon

calling as though such seemingly uncontrolled flight were the most joyous experience life could offer.

Toroweap Valley is a celebrated volcanic zone. The entire plateau is scorched by lava flows, pockmarked by volcanic bombardments, and singed by fallen ash. The cinder cones that rim the valley on the west side form the most characteristic geological feature of the Uinkaret Plateau.

Toroweap Valley is a filled-in canyon, about three and a half miles wide and sixteen miles long. Parts of the walls of this ancestral Toroweap Canyon are clearly discernible. Material eroded from the side walls, together with the detritus carried down the canyon by floodwaters, gradually filled the old canyon, forming the present valley. Near the canyon rim this fill is as much as 2000 feet thick. The attractive name, Toroweap, is from the Paiute word for greasewood. The floor of the valley abounds not only in greasewood but also in yucca, cactus, sagebrush, nolina, and the tall-stemmed agave *(Agave utahensis)*. Until fairly recent times the Paiutes frequented the valley in spring to pick the fruit of the agave, or *yant*, as the Indians call it. The fruit was roasted in stone roasting pits, whose smoke-blackened remains are still to be seen in the valley.

The geological history of the Toroweap area is similar to that of Grand Canyon National Park, but there has been visible alteration in more recent times. After the principal topographic features of the area had been developed and the side canyons cut, volcanic activity began. Great quantities of molten lava poured from the scores of volcanic craters and flowed down the slopes, changing the topography and building the 30-mile Pine Mountain Range, or Uinkaret ("Region of Pines"), to give the Paiute name.

The dominant peak of the region is Mount Trumbull, which rises 2000 feet above the surrounding plain and provides a convenient point from which to survey the geological features of the region. The mountain was named in honor of a U. S. Senator by Major Powell of Grand Canyon fame. From its summit nearly 170 craters may be sighted in a view that encompasses 40 miles of the North Rim country. Major Powell climbed the volcanic mound in 1870 and was moved to the following rhapsodic comment:

"Oh, what a view! A vision of glory! The Vermillion Cliffs to the north, with their splendor of colors; the Pine Valley Mountains to the northwest, clothed in mellow, perspective haze; unnamed mountains to the southwest, towering over canyons, bottomless to my peering gaze like chasms to the nadir hell; and away beyond, the San Francisco Mountains, lifting their black heads into the heavens."

The observer of today, unless he be a geologist, is not likely to be inspired to Powell's fervid prose, but he can nonetheless comprehend the extent of the volcanism that has convulsed the region. Southward from Trumbull is a particularly weird spot known as the Witch's Water Pocket. This is a broad, desolate waste where the lava is so rough, black, and jagged that it appears to have flowed within recent times. It has the appearance of a frozen sea of lava whose waves have been transformed into petrified black foam.

Early in the volcanic history of the region thick rivers of lava flowed southward, filling a deep, narrow gorge that once dissected the floor of Toroweap Canyon. The molten masses flowed 1500 feet along the valley floor, fanned outward to the brink of the Grand Canyon, and finally poured over the rim to the river below. Today the black masses stand out in marked contrast to the light-colored underlying layers of sedimentary rock that show between the various flows.

The lava cascades have been described by geologist John H. Maxson as the most spectacular recent geological feature of the western Grand Canyon district. The westernmost plateaus, the Shivwits and Kanab plateaus, as well as the Uinkaret, all display extensive fields of these basaltic lavas. Perhaps the most vivid reminder of the region's volcanic past is the long fill known as Toroweap Cascade. This is the spot where the fluid lavas poured into the Inner Gorge, choking the river channel at the junction of Toroweap Valley and the Colorado and erecting a 600-foot dam that stopped the flow of the river. When eruptive activity ceased, the water of the Colorado, heavy with its burden of sand, silt, and gravel, began eating away at the dam. Time has given the victory to the river. The Colorado has worn away the lava barrier and again flows unhampered through the mighty gorge. Evidences of the old dam are plainly visible today, patches of the lavas clinging to the walls on both sides of the canyon.

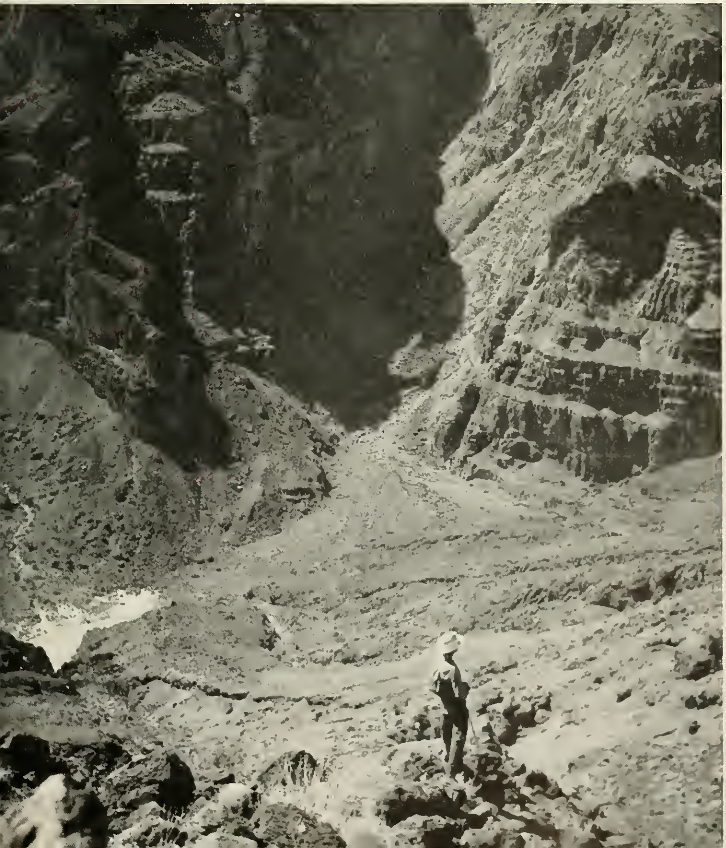
Perched on the brink of the valley, near where the lava cascaded into the gorge, are spectacular remnants of the volcanic activity of geologically recent times. On one side stands a 600-foot basaltic cone called Vulcan's Throne, one of the scores of small volcanoes formed in the area by the piling up of ejected materials. At the west base of Vulcan's Throne is the Toroweap Cascade, the break where the molten masses poured down the canyon wall and dammed the Colorado.

The most spectacular feat and certainly the most exhausting undertaking in the Monument is the descent of Toroweap Cascade to the Colorado River. This route permits one to enter the precipitous Inner Gorge from the canyon rim without benefit of a trail, a feat impossible at any other point within the Monument. Many persons have made the descent over the years, but practically none cares to repeat the performance. The only exception appears to be John Riffey, Park Ranger. Riffey makes the arduous trek every time he gets the chance. Some hardy hiker need only propose the undertaking and Riffey is off like a wild bee making for a honey tree. Mrs. Riffey does her best to discourage these acrobatic feats, declaring it takes Riffey two days to recover from the strain. The Ranger himself considers the stunt only an average day's workout and feels that he is getting soft if he permits any excuse to deter him from the trip. Mrs. Riffey did succeed in discouraging Virginia from attempting the trip.

The Riffeys are the sole residents of Grand Canyon National Monument and preside over a 200,000-acre preserve, which attracts at most 200 visitors a year. Disclaiming any semblance of loneliness in their isolated domain, Mrs. Riffey says, with a touch of humor, "We have lots

▼ Ranger John Riffey pauses in the descent of the lava cascade for the first close view of the Colorado. The vertical outcropping seen on the left wall is the remnant of the lava dam that once blocked the mighty Colorado

Photo by Alfred Schmitz



Photos by Alfred Schmitz

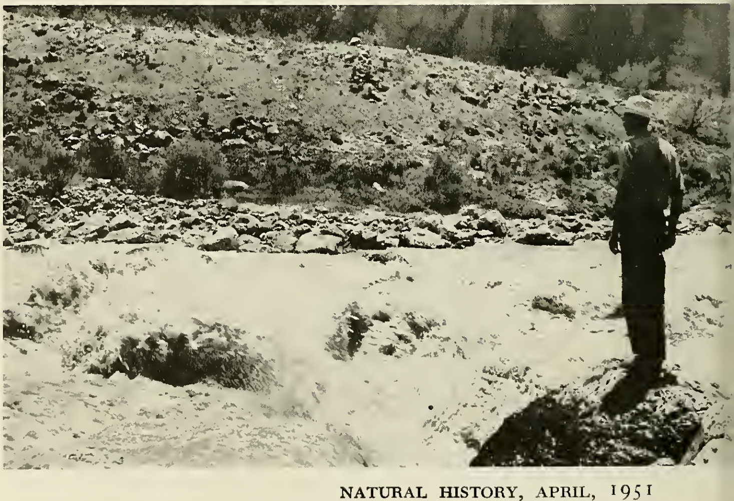
▲ WHERE the lava cascade met the Colorado

of neighbors, but all of them are four-footed."

Riffey, tall, rail-thin, and Colorado-born, is a graduate of Colorado A. and M. For a man in his thirties, he has had a diversified career, including several seasons in the Forest Service, two years of teaching school, and two years in the Army. He has been in his present post a total of six years, having held the position for a time before going into the armed forces. This is the post he likes best. He is sole monarch over a domain that stretches 30 miles from east to west. One of the great attractions of the job is that it permits him to take off on unannounced expeditions into remote corners of his preserve whenever the least excuse presents itself. Finding us willing accomplices, he proposed a side trip to the easternmost extension of the Monument to see what Riffey and other National Park Service men term the most unusual panorama of the Grand Canyon obtainable from the North Rim. Since his ancient Park Service truck was not equal to the rough trip, he suggested we use Schmitz's carryall, an arrangement that would enable him to make a tour of inspection of the area and at the same time take us into a seldom-visited part of the North Rim country.

The section Riffey aimed at was Kanab and Boysag points, two promontories that jut into the Grand Canyon in an area some 50 miles south and east of Fredonia, Arizona. Since the two points are off the beaten track and are approached over primitive roads utilized solely by sheepherders' wagons, it is little wonder they have been neglected.

The five of us, including Ranger Riffey and his wife, climbed into the carryall and began the spine-shattering drive to the east. Leaving Riffey's headquarters at Toroweap Valley, we bounced over 50 miles of sagebrush plain, which were relieved at intervals by clumps of cliff rose and Apache plume. As Riffey had foretold, the views from the two points are unlike any others on the North Rim. Here one sees mostly the land surface of the great gorge—the mesas and side canyons—and little of the river. The prevailing hue is an apricot shade, and the great sunken plateau is as irregular as a jigsaw puzzle. Viewed from the rim, the river is insignificant and fills an infinitesimal part of the canyon's area. Here the stream takes second place in interest to the canyon, which is not a single abyss but a series of chasms, each of major proportion. While the eye takes in a 40-mile sweep, only a mile or two



of the river is encompassed. The view is so extensive that at Kanab Point one can look eastward into the Thunder River country,[1] and at Boysag, the view is southward into famed Havasu Canyon.[2]

Actually, what the eye sees is too extensive for ready comprehension, and one is soon surfeited with canyon scenery. Perhaps the individual, dwarfed by the scene before him, subconsciously resents having to play a secondary role even to such a stupendous work of nature. The 100-mile round trip was a full day's excursion and left the party pretty much wilted. However, a good night's sleep found us ready for our major undertaking in the valley—the descent of Toroweap Cascade to the Colorado River.

After Riffey had established his regular daily radio contact with the South Rim across the canyon, we took off in his half-ton truck. The approach to the head of the cascade circles the west base of Vulcan's Throne. Riffey parked the truck at a dry lake in the valley, and we plodded across a mile-long tongue of volcanic detritus consisting of black ash and large basaltic blocks. Turning the west shoulder of Vulcan, we found ourselves at the incline where the lava had gone cascading into the river. This is the roughest and surely the most dangerous course down to the river but also the most rewarding, since it follows a route of great scientific interest. On all sides are evidences of the extreme volcanism that rocked the region in ages past. Prior to the extrusion of the lavas, a canyon was cut along the Toroweap Fault leading from Toroweap Valley into the Grand Canyon. Flow after flow of lava and basalt poured down this gulch through the centuries, filling up the mouth of the former Toroweap Valley. Today the black lava stands out like smudge on drifted snow and fills the gorge like coal that has been dumped down a chute. It is jumbled in utmost confusion, and it tumbles down the wall at an angle of perhaps 35 degrees, a slope that adds to the hazards of the descent.

Present-day geologists recognize four distinct stages in this volcanic

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[1] See "Thundering Waters," by Philip Ferry in NATURAL HISTORY for June, 1949.

[2] See "Canyon Utopia," by Philip Ferry in NATURAL HISTORY for February, 1950, and "The Home of the Blue-Green Water People," by Josef Muench, April, 1940.

Photos by Alfred Schmitz

▲ **WHITE WATER** of the Colorado. Note black remnants of lava on the bank of the river

RANGER RIFFEY contem-
ates the foaming Colorado as
boils over the last remnant
the barricade of lava it re-
oved

➤ **THE COLORADO RIVER** at the base of Toroweap Lava Cascade, showing the great blocks of lava that remain to remind the visitor of a volcanic cataclysm that challenged the river for a time activity. The lavas of the inner canyon at the foot of Toroweap Valley have been subdivided into Lower, Middle, and Upper Canyon groups. It is the Middle Canyon lavas that filled ancestral Toroweap Canyon, while the Lower Canyon group dammed the mouth of Toroweap Valley. The bottom two units of the Lower Canyon group are described as single, massive flows; the upper two units are made up of layers of thin flows. The Middle and Upper Canyon lavas poured over the older lavas as one layer of chocolate frosting might be superimposed upon another. Both flows are thick and composed of dense olivine basalt.

The over-all descent of Toroweap Cascade is 3000 feet. This figure is misleading when compared with the regular trails into the canyon, which are from seven to eighteen miles in length. The figure takes on significance when it is pointed out that virtually all of this drop is made down a massive chute choked with detritus, where one is either slipping, sliding, sitting on one's haunches, leaping from boulder to boulder, dropping down six-foot ledges, or performing other desperate gymnastics. The descent is one of the most trying performances one could wish to undertake in the name of pleasure.

There is no trail. The descent is down a natural drainage channel, which is choked with cinders, ash, and huge blocks of basalt. The footing is insecure in the extreme, and the descent is a wild scramble from which even the most agile emerge considerably bruised. Frankly, the trip is not one to be recommended indiscriminately. It is a rough-and-tumble escapade, where human shins wage an unequal contest against an unyielding mass of volcanic detritus that has withstood the ravages of centuries.

There is never a break in the exhausting progress. The upper portion of the lava flow is quite broad, but the black mass narrows toward the bottom until the concluding few hundred feet are made through a break created by a deep volcanic fault. The final drop to the river is down a long chute, where the chief worry is the ever-present danger of suffering a twisted ankle, a wrenched knee, or a broken bone. Such a mishap would have necessitated abandonment of the objective and the transporting of a cripple in a most difficult situation. Yet because of the insecure footing, avoidance of such a calamity appeared to be sheer good fortune. Those below must be on the alert against falling rock and rubble dislodged by those above. Handholds are few, the scattered shrubbery is easily pulled out of its shallow base, and the prevalent barrel cactus and opuntia would, of course, offer security only to a desperate person.

The climax of the scuffle is reached at the bottom of the cascade. Here is Lava Falls rapids, a roaring, plunging cataract. "Rivermen" consider it to be one of the three most dangerous rapids in the whole Colorado. This is the spot where the 600-foot lava dike once dammed the river, and remnants of the dam are visible to this day on the canyon walls above.

Our group of three — Schmitz, Ranger Riffey, and I—made the descent from the rim to the river in two hours. The return trip required three. This is good enough time considering the hazards involved and the heat of a desert sun. But Riffey reports that geology students from a near-by college, familiar with the route and imbued with youth's reckless indifference to danger, claim to run and slide down the long chute in something like an hour.

The return trip up the precipitous slope, at a time when we were already fatigued by the descent, was wearying beyond words. The climb in a hot afternoon sun can be murderously exhausting, and it is likely that every person who has ever made the round trip has asked himself why he was ever rash enough to succumb to the lure of the stunt. A plentiful supply of drinking water is a vital necessity. We had taken the precaution of caching two large canteens at intervals on the descent and as a result were well supplied on the long pull back.

Toroweap Valley is some 4500 feet above sea level. Remote though the valley has always been, it was one of the earliest explored in Arizona and Utah. The Spanish padre Silvestre Velez de Escalante and his Franciscan brother Father Dominguez crossed the valley in 1776. The padres had set out from Santa Fe to find an overland route to Monterey, California, an undertaking that failed.

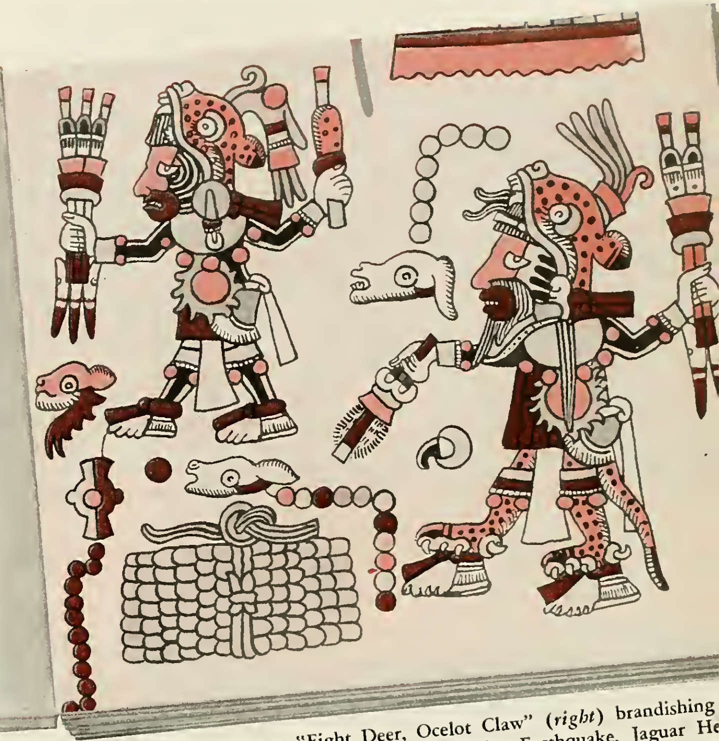
Generations of hardy homesteaders have run cattle in the long valley, although the scant rainfall is a regularly recurring threat that may make it necessary during a prolonged drought to shuttle the beef stock from range to range in search of feed. Since this involves rounding up the cattle and transporting them by motor truck, the expedient is not only a difficult one but expensive as well. When we visited the valley last May, the ranchers complained that they were enduring their ninth successive dry year. The drought was so general in northern Arizona that the state found it necessary to evacuate the buffalo herd from its regular range in Houserock Valley, 100 miles north of Toroweap.

To those seeking solitude, Toroweap Valley offers a perfect retreat. So remote was the valley in years gone by that it provided a refuge for polygamous Mormons and formed a hideout for cattle thieves and assorted renegades. The notorious Butch Cassidy gang frequented the valley, Cassidy himself having been reared in near-by Kanab. To this day, the law would have a difficult time flushing out a fugitive familiar with the topography of the country.

There is something unreal about the Toroweap country. Empty and isolated as it is, with its inescapable evidences of volcanism, including the hundred or more craters that rim the valley, and the dikes and lava flows that stand out so prominently, it has the appearance of an imperfect cosmic body still in the process of being formed. It seems part of the unfinished past, and Man appears an intruder. Or perhaps it belongs to a future whose final chapter of violent creation has yet to be written.

Within these vigorous documents lies a fabulous saga of magic, adventure, and romance—the life of early Mexico

The Picture Books of Ancient Mexico



▲ THE GREAT WAR CHIEF "Eight Deer, Ocelot Claw" (*right*) brandishing weapons as he marches with his brother, "Twelve Earthquake, Jaguar He (*left*). Minor differences in face paint and ear ornaments indicate the rank of two chieftains. (Mixtec Indian, Codex Nuttall)

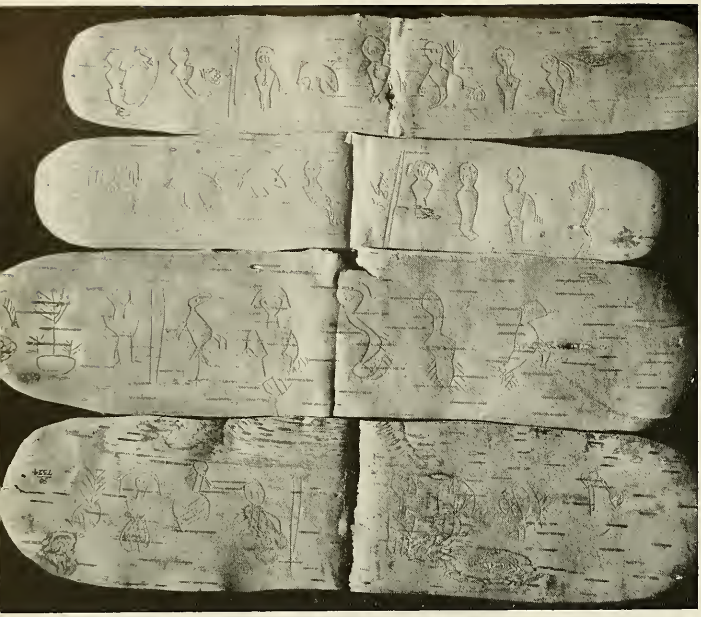
BY
C. A. BURLAND
Honorary Curator, Abbey Art Centre Museum, New Barnet, Herts, England

IF you are one of those people who believe that history is a spiral and that space is expanding, I will forgive you if you fail to be surprised when you meet a Mexican Codex. I shall, however, hardly regard you as human if you fail to show a quite definite emotional reaction. Most people fall in love with the painted books at first sight. They are so colorful, so vigorously alive, so well designed. A full-color television program from the Disney Studios is the closest comparison in modern life that I can imagine. They are of too high a standard for the comic-strip technique, and, in any case, they need a spoken commentary. They were designed for just that purpose. In fact, these painted documents belong to an educational system that truly foreshadowed many of the most practical ideas in visual education today.

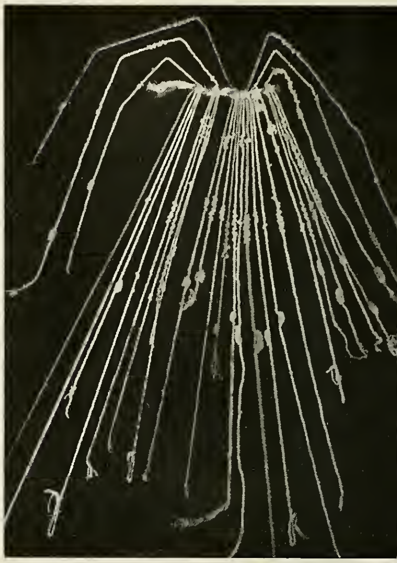
It all started in the Stone Age. As soon as human beings separated from their tribe, they found themselves seeking some way to leave messages. The world around held fruitful inspiration—a broken twig, a blaze on a tree, even a picture of an animal; these were the beginnings of all our ways of sending thoughts across the barriers of time and space to other human beings.

The American Continent, once mankind had spread that far, became an enormous field laboratory in which men could try out all kinds of ideas, uninfluenced by their relatives in the Old World. That is why we anthropologists are so interested in what American Indians have been doing in the last 20,000 years or so. Among their most interesting inventions were a variety of recording devices from wampum and quipu (knotted strings) to the Maya hieroglyphs and the forms of writing described in this article.

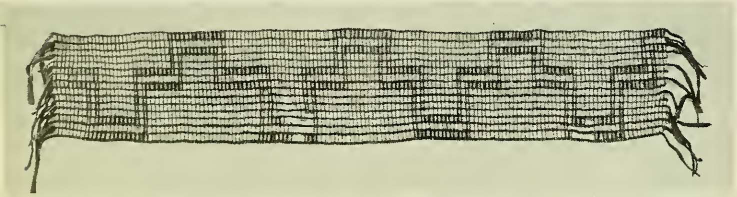
I suppose the simplest social background in which picture writing developed to any great extent was that of the Ojibway Indians, whose wise men were members of the Midewiwin Society, a secret religious organization. The chants recited and the visions seen by these people were recorded on scrolls of birchbark. They were quite simple series of drawings in linear progression, intended to remind the chanter of the events that his words described. Manitous, humans, animals, and profile sketches of places all added up to an associative sys-



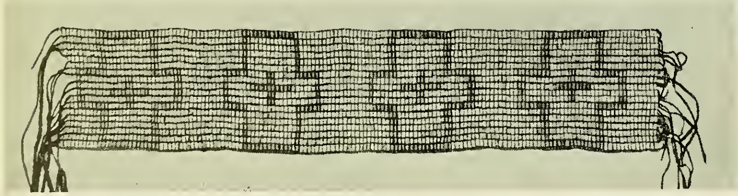
▲ RECORDS OF the Ojibway Indians of Minnesota. These simple pictures scratched on birch bark were understood by men who had been initiated into the meaning of each symbol. They were intended to refresh the memory. Most Indians had some such system of records



▲ KNOTTED STRINGS KNOWN as "quipus" were used by the ancient Peruvians as memory aids. Otherwise the Peruvians scarcely used even simple pictography



THE PENN WAMPUM belts: bead "documents" signifying the transfer of land. The upper belt is the "Freedom Belt" and signifies the right of the Iroquois to traverse the land in pursuit of whatever they needed



tem which guided memory and kept the narrator closely to his text. The double linkage was such that memory was incomplete without both elements—sound and picture. This often led to complications. If a group of pictures were lost, it was assumed that the story was no longer in existence, and reconstructions were not always made. In this context we have the extraordinary case of the Miami whose bird-bone "wampum" was lost in a fire and who, as a consequence, had no history!

It is when we come to deal with the Indians of the Southwest that we meet with a higher level of recording. It is often associated with a very ancient religious system, accepted in one form or another by the Indians from the Diaguite of Argentina, throughout the Andes and Central America as far as the Mississippi. The essentials of this cult were ideas of emergence from four previous worlds, of a universal flood, of water and thunder serpents, sun eagle, earth jaguar or puma, the Old Man Trickster (coyote), the four colors of the Maize, and Protective Power in the Rainbow. Because of the strange unity of belief in this tremendous region, it is often possible to "read" Indian works of art in spite of the wide diversity of social customs and languages.

This is precisely how we are placed with regard to the painted books of Mexico. They are the products of widely diverse tribes and yet have so much in common that it is possible to decipher a document and still have only the vaguest idea as to which tribe originally painted it. In fact, the similarities of style in the surviving Mexican codices are so overwhelmingly greater than the differences that it took centuries for the few scholars who ever studied them at all to realize that they were not all Aztec.

It is now time to describe them. They are usually strips of finely tanned skin, from seven to twelve inches wide, folded into nearly square pages. They close up rather like a map. Some were written on a coarse paper made from the inner bark of the *amaquauitl* or paper tree. These were painted upon direct, with some remarkable ink which did not run, even though the *amatl* was as absorbent as blotting paper. The skin documents, however, were more carefully prepared. First a layer of white paint was applied and smoothed down. (It seems to have been an oil-bound lime preparation, which dried with a glossy surface.) Upon this the artist drew his pictures according to a strict code of proportion. Some of the documents, including the Codex Nuttall in the British Museum, show where the artist has made corrections by painting over his errors with white and redrawing the picture. Yet in others, such as the truly amazing little Codex Laud in Oxford, the perfection of the drawing seems to have been attained at the first attempt: a wonderful achievement of craftsmanship.

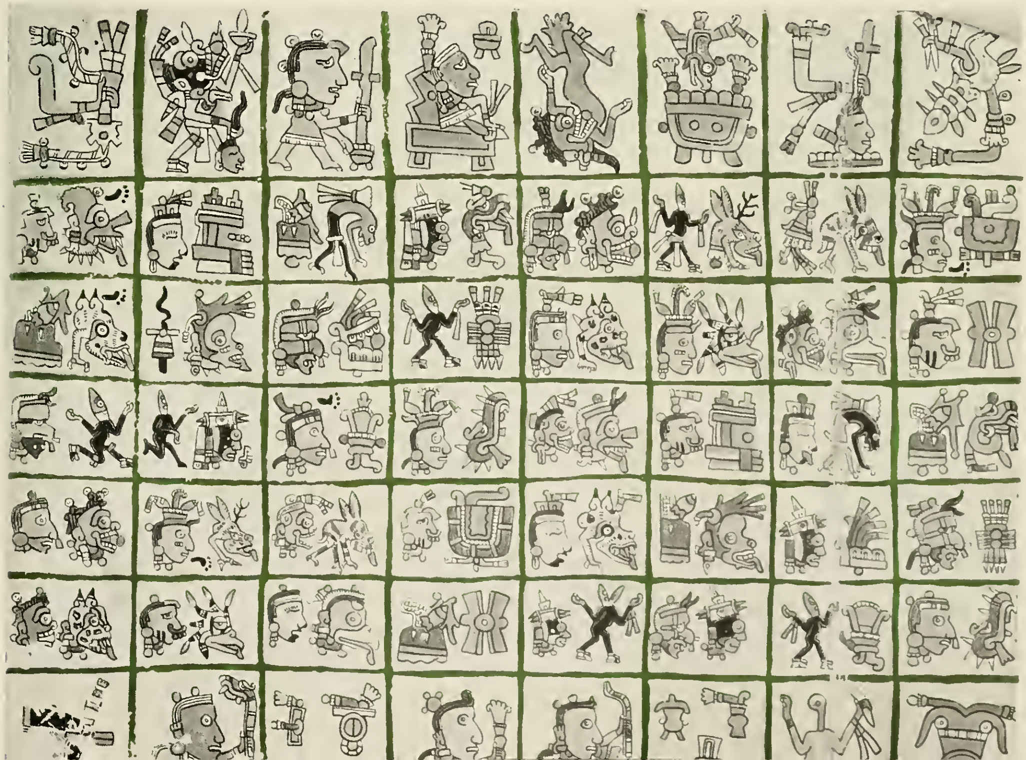
Now, what were the subjects depicted by the artist? History, religion, and statistics. Of the remaining pre-Conquest codices (excluding the three of Maya origin), one is statistical (The Tribute Roll of Montezuma), seven are historical (Vindobonensis, Nuttall, Bodley, Selden, Colombino, Waecker-Götter, and Boturini), and eight are religious (Borgia, Vaticanus 3773, Laud, Fejervary-Mayer, Cospiano, Borbonicus, Aubin, and the Selden Roll).

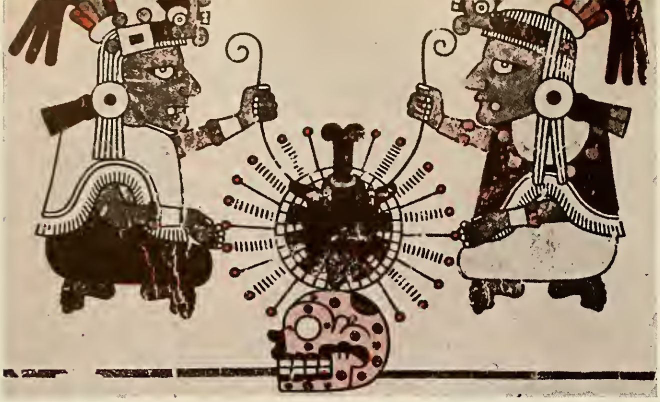
Although we can "read" these codices, we have small knowledge of their literary value. It is rather as if we had a movie drama without its sound track. We know the subject and the names of the people concerned, but each of us must recount the story in his own words. Of the sound of the hymns enshrined in the religious books, we have only the few words recorded by de Sahagún. Of the histories, such writers as Ixtlilxochitl, Tezozomoc, and Camargo convey the sense as understood by the Indians, but it is unlikely that their Spanish is a direct translation of the words of the history as memorized by the Indian record keepers.

It is certain that rhythmic, poetic forms of speech were used in repeating the stories painted in the books; but the religious works were often a kind of mathematical table for recording fortune and misfortune. They were tools of the trade for various priests and prognosticators, whose business it was to give assurance and peace of mind to the superstitious populace. There is no reason for us to think that the Mexicans regarded their magic books as having power in themselves. They saw these repetitions of days and numbers, of gods and offerings, as the statement of a philosophy.

Most of the works are expressions of a kind of "rhythm of the universe" approach to reality, but occasionally something different appears. A little picture in Fejervary-Mayer represents the Supreme Be-

▼ PART OF A fortune-teller's equipment: a page from the Books of Fate, in Codex Cospiano. Here and there a black footprint marks a day specially favorable for childbirth





▲ A Mexican conception of the supreme being. This double diety was mentioned by early missionaries but has no name. It was both male and female. The diety holds the spirit, fluttering like a butterfly, above a skull. (From Codex Fejervary-Mayer)

ing, The Unnamed, The Old Old Ones, The Two, as the Giver of Life. In the terrifying pages of Codex Borgia, now safely in the Vatican Library, we can read of the birth of the gods from a stone knife, expressed as a dualistic belief based on the movements of the planet Venus. Morning Star, Quetzalcoatl, the Precious Twin is opposed eternally by Evening Star, Xolotl, the Beastlike.

In places, even the beautiful Codex Laud has shocking revelations of the extent to which witchcraft entered into the religious system of old Mexico. One has only to study the pictures of Tlazolteotl, the Witch-Goddess, to realize that. In fact, the study of the surviving religious books makes one feel that it was a good thing for the honor of Mexico that Archbishop Zumarraga had most of them burned. It is as if an earlier and purer belief (not unlike that of the Navajo Indians) with a strongly marked dualism had been overlaid with several other beliefs, too many of which had a queer psychological twist toward destruction and filth. The sex side of these cults is marked in the books clearly enough, but it more often seems a rather childish perversion than the joyful letting off of steam which characterizes the more normal nature cults.

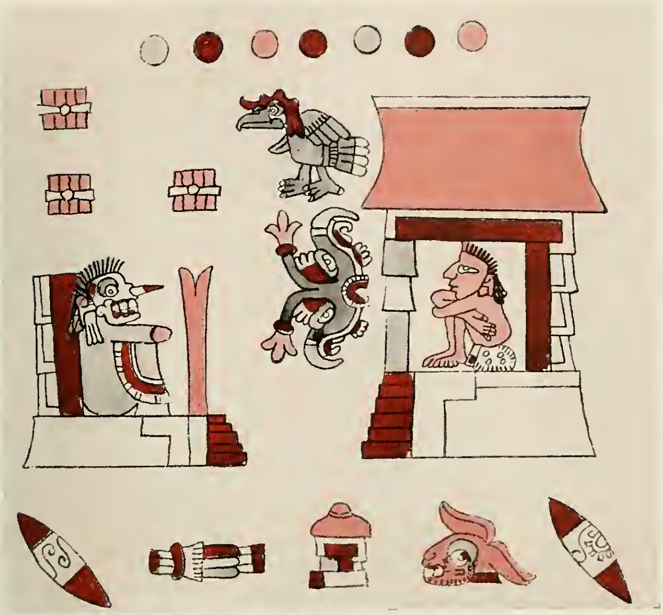
With the history books it is different. We enter a world where a normal human can feel at home. There is the straightforward simplicity of Codex Boturini to bear witness to the qualities of organization that the Aztecs possessed in such good measure. Glyphs, place names, people, and their personal names all follow a direct sequence through time. Even to those of us who have no clue to Mexican glyph reading there is evidence of purpose and sequence that would naturally lead to an understanding of Mexican writing systems. The subject of Boturini is the migrations of the Aztecs, first from Aztlan with the other Nahuatl-speaking tribes to the place of Seven Dwellings, the Chicomoztoc, and thence alone to the Valley of Mexico. The story breaks off with their arrival and the Battle of the Ears, which is the last event recorded about the Mexicans while they were subject to the chiefs of Colhuacan.

Among the Mixtec histories we find ourselves to be in a country as exciting and unpredictable as the Mixtecs' own mountain homeland among the cloud-capped peaks of Oaxaca. Much of our difficulty with this, the largest group of codices dealing with one subject, has been the aristocratic tradition of the Mixtecs themselves. They were an ancient people and had formed a very important section of the Toltec confederation — whatever political form that still mysterious culture may have taken. They date their histories from the bringing in of the Toltec cult of Quetzalcoatl and the arrival of his symbols, including a medicine bundle and the Staff of the Morning Star, to the local temple. Each chiefly family kept its own genealogy with the most exclusive care, but it is rare that any were willing to admit the possibility of being a junior branch. Therefore, there are all manner of disjointed genealogies in the larger codices, which need a great deal of research to bring them into a general historical scheme.

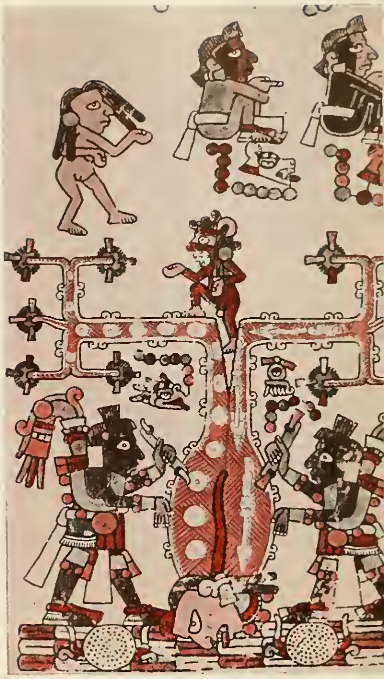
However, two of the Mixtec codices deal with a far longer period than that which followed the fall of Tula in the tenth century. Vindobonensis, of which a fine facsimile edition was made in 1928, and the Codex Selden (only inadequately reproduced by Lord Kingsborough in 1831) purport to begin with the creation and continue to the birth of the Mixtec nation and the descent of Quetzalcoatl. These documents must have formed the basis of a tremendous chant, one of those epic paeans that linked the chiefly family and the people in a common emotion of pride in the glorious achievements of their race.

The lesser works, including the strangely irregular Codex Nuttall, still retain their charm, but they tell stories more akin to Red Indian romance and adventure. They give a great deal of space to the national hero, Ocelot's Claw, surnamed Eight Deer, who extended their power to its widest limit, even to Tehuantepec, in southernmost Mexico. The Mexican calendar system was based on cycles of 52 years. The peculiar fact that Eight Deer died as a human sacrifice exactly on the completion of his fifty-second birthday—an exact calendar-round —made it only too easy for many early students to assume that he was a calendrical myth. It was not until 1912 that Major James Cooper Clark was able to show that Eight Deer was a real person.

The "Eight Deer" group of codices were long suspected to be of Mixtec origin, but proof of their tribal origin had to await the discovery that the genealogical records of the Codex Waecker-Götter were annotated in a Spanish hand but in the Mixtec language. This was further clinched by Dr. Alfonso



▲ **In the technique** of recording and conveying messages, the peoples of Mexico made great strides over other groups in the Western Hemisphere. Here we see one of eight pictures covering 360 days and representing various aspects of the death god. (From the Codex Laud, Kingsborough edition)



▲ **The birth** of a nation. From a tree rep sented as a goddess, two minor godlin (Seven Eagle and Seven Rain) carve a dru (Codex Vindobonensis)

Caso's discovery that the post-Conquest map of Teozacoalco recorded land claims of Mixtec notables. They proved their case by reference to genealogical tables which included the great Ocelot Claw (Eight Deer) in person and many of the other figures well known in the historical codices. From this followed many other discoveries, which are being published by Dr. Caso and which I do not intend to discuss here. Thus it may indeed sound as if we had solved most of the problems of the Mexican picture writing. As a matter of fact, the more we know, the more problems confront us. There are still many symbols that cannot be read. There are the social systems of the Mixtecs to be explored and the legends to be discovered that gave rise to some of the more surprising pictures in the religious books. Or did the legends really only form a popular rationalization of a priestly philosophy, of which we now have only the vaguest notions?

Then there are questions of beginnings: When and where did these systems of writing and calendrical record originate?

Finally comes the problem that fascinates me most. What is written on the hidden document beneath Codex Selden? Only in July, 1950, did Dr. Caso visit England and discover that this document was a palimpsest—a record on top of a record. He asked me to follow up his discovery, and there is no doubt whatever that underneath the white verso side of the Codex are the vestiges of a more ancient painting. It is possible to see one or two parts of figures, the flame of a torch, parts of date symbols, etc. There, hidden at the moment, lies an ancient Mixtec painting that has not been seen for nearly five centuries. Shall we glean any new facts? Who knows? If the chemical experts and photographers can produce a picture, even a hazy one, then we shall be able to say with certainty what the subject is.

There! We have traveled from a general viewpoint to the particular—from the transfer of thought by signs and symbols to one single precious document in the Bodleian Library at Oxford. We have become specialists! That will do no harm if we are also willing to spend time on the general problem of how mankind learns to transmit his thoughts, and then apply our hard-won knowledge to the practical work of education for a future, a more civilized way of life.

Meanwhile it is very pleasant to spend an occasional evening at leisure poring over the painted books of ancient Mexico. If any of my readers should own one, pray lend it to me or send me photographs for which I cannot pay. But if you are a millionaire, there is room to help other students to learn these matters. The Mexican documents still only available in the inaccurate Kingsborough edition of 1831 should be properly reproduced in facsimile. There is valuable work to be done, if we are given time, in making these things available to science throughout the world.

▲ Great Gull Island, within sight of civilization but completely isolated by the absence of all communications. Plum Island slumbers in the background

AN Island Venture

The experiences of two Miss Robinson Crusoes who spent a month for science on an uninhabited isle

By Lois J. Hussey and Catherine M. Pessino

Photographs by the authors

To most, a deserted island means a sandy atoll, swaying palms, a tropic moon, and leisure. For us it was an island just three and a half hours by train and boat from New York City, treeless, foggy, with summer storms and work. There we were to spend 28 days alone, within sight of civilization yet removed, without radio, telephone, or boat.

"Our" island, as we now think of it, is Great Gull Island, eight miles east-by-north of Orient Point, Long Island. The American Museum of Natural History received title to this island in 1949. For many years it had been the property of the United States Government, which purchased it in 1803 and allowed the lighthouse personnel on neighboring Little Gull Island to use it as a garden.

The Keeper's journal for 1833 reveals that a team of oxen was bought by the keeper, Mr. Chase, and kept on Great Gull during the summer for plowing and hauling. However, the island's large population of meadow mice made gardening unprofitable. During droughts, when the cistern at the lighthouse was empty, water was hauled from the well on the larger island. Driftwood, collected along the shore, was an important source of fuel at the lighthouse whenever stormy weather delayed the arrival of a packet sloop laden with cordwood.

In 1897, the Government began the erection of Fort Michie, and until after World War II it was part of our East Coast defense guarding the approaches to Long Island Sound. Improvement in defense techniques rendered it obsolete for this purpose, and now it is to be developed as a bird sanctuary.

During the early years, Great Gull Island was famous for the large number of terns that nested there. In the last half of the nineteenth century, these birds were ruthlessly slaughtered for the millinery trade —so much so that they all but disappeared from the Atlantic coast. Boatloads of gunners greeted the birds returning south from their winter homes; eggers persistently robbed the nests; fishermen, too, accounted for many. One season 40,000 skins were taken from a single colony.

In the summer of 1889, a Museum expedition under the direction of Dr. Frank M. Chapman was sent to Great Gull Island to study the colony of terns. At that time Great Gull Island, and Muskeget and Penikese Islands off the coast of Massachusetts, had the only large colonies left from New York to Maine. They managed to survive only because the islands were uninhabited and relatively inaccessible. To protect the colony the Linnaean Society, the West Side Natural History Society, and the American Society for the Prevention of Cruelty to Animals, all of New York City, joined forces to pay for the appointment of the lighthouse keeper as State Game Protector. In 1896, he reported 7000 pairs of nesting terns on Great Gull.

The very next year saw the beginning of Fort Michie. Buildings and matériel covered most of the island, leaving room for only 2000 terns. Not a single egg was allowed to hatch that year. Most were eaten by workers who were not provided with meals by the construction company. As many as a dozen per day were eaten by an individual. The remaining eggs were blown empty and the shells carried off as souvenirs.

With the more intensive protection accorded the terns since 1900, a few colonies have once more been established on the southern and eastern shores of Long Island. Today, the rapid development of summer resorts in this region again

▲ **Catherine Pessino standing** in a tall growth of chicory and melitot, the two most abundant plants on the island. Decoys were planted among these growths in an attempt to lure the terns back to Great Gull

▲ "**Home**" was a four-story observation tower, remnant of abandoned Fort Michie. The Army had stripped the building of all conveniences, leaving behind only the busy house mice

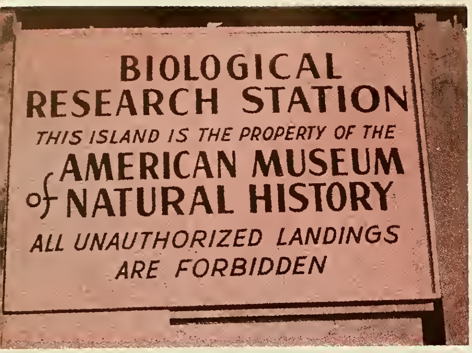
▼ **Coast Guardsmen** departing on the patrol boat "Noel," leaving the authors on Great Gull in complete isolation

jeopardizes the existence of these birds. The number of Common Terns and Roseate Terns in the colonies around the Orient Peninsula has decreased in the last few years. The need for a new, protected site in that general area is acute.

Now that the American Museum of Natural History has title, a joint committee from the Museum and the Linnaean Society has been formed to develop the island primarily as a nesting site for terns.

Our purpose in going, aside from a desire to organize and successfully carry out such a venture, was to find any evidence of nesting terns; to determine, if possible, the probability of the return of a colony; to gather facts as to the number of trespassers and any other information that might assist the committee in deciding upon a future course of action.

Transportation to and from the island proved to be something of a problem. We could either charter a boat or engage some friend of the Museum. We knew that our only neighbors would be the United States Coast Guard at Little Gull Light Station, a half mile to the east. Since we would be alone, without telephone or boat, our friends thought it best if the Coast Guard knew of our proposed stay on the island. We learned that the personnel made frequent trips to New London, Connecticut, for mail and supplies, so we asked if we could be put ashore at Great Gull on one of



▲ A STERN WARNING from the American Museum, which is undertaking to develop the island as a nesting site for terns. Trespassers can inadvertently disturb a colony enough to cause the birds to leave

➤ IRON RUNGS set in the concrete walls of the tower led up through hatchways to the floors above. The forced exercise was good for the waistline but hard on the hands

▼ MISS PESSINO prepares a meal on a Coleman stove. The two five-gallon jugs contained the only fresh water on the island and were used only for drinking

those trips. Permission was kindly granted, orders obtained from the Commander, 3rd Coast Guard District, and we were off, not as expected in an open 20-footer but on an 83-foot patrol boat. Actually, by the time our supplies were assembled on the dock—supplies that had been begged, borrowed, and appropriated from among the Museum's storehouse of equipment – we felt that 83 feet were none too many. Sleeping bags, rope, pail, sun-tan lotion, plant press, sulpha powder, hammer, nails, labels, gasoline, ponchos, mouse bait, and alarm clock were but a part of the provisions carried aboard.

We saw the island for the first time through binoculars. The word "deserted" had been thrown at us so often by people who had tried to dissuade us that we were astonished to see towers, buildings, and gun emplacements silhouetted against the gray sky. We had seen photographs; but, somehow, to see it all there before us was as surprising as it was exciting. The men aboard the "Noel" wondered why we had not chosen to vacation in Bermuda, Cuba, or Atlantic City. Why had we picked this unmanned spot? They regaled us with stories of "poisonous snakes," "mosquitoes so large that one holds you by the arms while another sucks blood," nor'easters that send waves piling overhead, fog, shipwrecked sailors, and more.

After tying up to the 250-foot dock, which had been constructed by the army on the north side, the crew helped us carry our supplies into the nearest building. As the old well was no longer in existence and no fresh water was available, special care was taken with two five-gallon jars, our entire supply. The army had given up its search for a large supply of fresh water after drilling to a depth of 1800 feet and had constructed a storage tank with a 172,000-gallon capacity to hold water carried in by tank ships. Our two five-gallon jars were to be used solely for drinking. Dirty faces would not matter.

A dense fog had rolled in shortly after we docked, so the "Noel," upon departing, was lost to sight immediately, making our isolation more pronounced.

The first task was to decide where to live. There was no housing shortage provided one was not particular about absent windows, warped doors (or none), dampness, debris, no water, electricity, or other conveniences. We decided to use a four-story concrete observation tower, the only place where the island could be viewed in all directions. The ground floor was left vacant. Its roof, which extends out from the first floor, was used as a porch or sun deck. The first floor became a kitchen and, with buckets of salt water, a washroom. Unlike the upper floors, there were no windows to let in the sun. This made it an ideal storage place for our food and fresh water, very like the cold cellar of a farmhouse. The second floor was used as living quarters, the top for sleeping. Iron rungs set in the concrete walls led up through hatchways to the floors above. Invariably, the one item we reached for was on another deck. The forced exercise was good for the waistline but rough on the hands. We scrounged shelves and racks from other buildings, put up cots, made a bench and tables, tacked cheesecloth and newspapers over the empty window frames to keep out insects and dampness, and were soon shipshape.

Before accomplishing all that, we undertook a more intensive exploration. Tons of granite from the New York City subway excavations have been dumped around the island to prevent the shore line from washing away. Much of the surface is covered by hard-top roads and railroad tracks. The cattail swamp, once the habitat of the meadow mouse and toad, is gone. What dirt once covered the island is now part of breastworks for the gun emplacements. The island is honeycombed with tunnels. By flashlight we searched the underground reaches, finding nothing but dampness and tumbleweeds. It was difficult to imagine the place with electric lights, shouts, commands, the rumble of overhead conveyors, the bustle of repair shops, and all the other activities of a garrison of 400 men. It was easier to imagine the island as it once was when just terns, gulls, meadow mice, toads, and other creatures ruled.

When an army moves out, everything of any intrinsic value, and more, goes. Even the light switches had been stripped from the walls. The only things left, excepting the concrete, brick, and corrugated buildings and the dock, were house mice. They could find nothing in the buildings, and by the time we arrived they were established in the grassy places, fat with insects and seeds, digging shallow burrows for protection. The house mouse, brought to the island by man, has supplanted the extinct Great Gull Island Meadow Mouse, *Microtus nesophilus*, which had ruined the lighthouse keepers' gardens. The first trap we set yielded one sore thumb. Even though we realized the improbability of finding one of the meadow mice, each time a trap was sprung hopes ran high—the same type of wishful thinking that in years past caused people to search Great Gull for pirate's treasure.

On the fourth day we received our first mail. The arrival of the postman, one of the men from Little Gull, was announced by a family of Spotted Sandpipers near the dock. The adults, worrying about the safety of their young, never failed to call out in alarm when anyone appeared. After that a Coast Guardsman, en route to the mainland, stopped once or twice a week to see if we needed any supplies and to check on our welfare. All this attention was unexpected and very welcome. We arranged a system of signals with the Chief at the light station: long red underwear hung from the top of the tower by day or red flares by night were to serve as an SOS. Fortunately, the occasion never arose when it became necessary to signal for help.

The preparation of meals was a simple matter, as we both knew how to use a can opener. The week before departure we had walked up to the checkout counter of a local A & P with $35.96 worth of canned foods (four baskets of small items). We did our cooking on a Coleman stove. Cans were opened in rapid succession, the contents tossed unceremoniously into pans, and all was ready for serving in a few minutes. The owner of the gasoline stove, a veteran camper, had boasted of his cornbread made over the open flame. Not to be outdone, our specialty was shortcake, buttered and topped with raspberries, both from cans. Weather permitting, meals were eaten on the sun deck. Our only actual purchase, other than food, had been two folding aluminum chairs. These, drawn up to an improvised table — drawer plus board—made a comfortable setting. Between bites it was possible to watch life around us.

Our noisiest inhabitants were a family of killdeers, *Oxyechus vociferus*—"vociferus" indeed! They, in addition to song sparrows, red-winged blackbirds, and spotted sandpipers, made up the nesting population. It was possible, by determining their territories, to discover the number of breeding birds. By the time we arrived, June 25, all the young had left the nests (but not the island), except for a family of redwings. Several hours of patient observation revealed the young of all but the killdeers, who managed to lose themselves in the tangle of weeds. We had given up all hope of seeing

▲ LOOKING TOWARD Little Gull Island, a half mile east. In 1803, lighthouse personnel there were permitted to use Great Gull as a garden, but meadow mice made the venture unprofitable

them, when one stormy day we happened to look out a window to see one of the adults walking along the road with the young–four balls of fluff, comical in appearance and antics, scurrying along on stilts, stopping now and again to tug at some food.

We observed 37 species of birds during our stay. Some, like the bank swallows, black-crowned night herons, cormorants, gulls, and terns, were daily visitors. Occasionally a yellow warbler, brown thrasher, phoebe, robin, or redstart would spend a few hours or a night. Other months the number of species would surely increase considerably, for Great Gull is on a well-traveled migratory route. When we left, July 22, flocks of dowitchers were already flying over the island on their southward migration. One day we had an unexpected caller, a pigeon, far from the sociability of city pavements. He spent a solitary hour walking on the roof tops. We later learned that our visitor was Elmer, our neighbor's pet. Elmer had been fed on his first visit to the lighthouse and had remained ever since.

Since the terns were our main concern, it had been disappointing the first day to find that none were nesting on the island. Still, they acted as if the island was their own, constantly molesting other birds that fished in the area. On most of their fishing expeditions to the island, the terns discovered the one or two ospreys. When this happened, a great alarm went up. An angry, screaming mob of perhaps a hundred or so terns took to the air. All was wild excitement. Each darted down at the interloper who had invaded their fishing grounds. Through it all the osprey remained indifferent, departing only when a fish had been caught. Undoubtedly there were young ospreys on a nest waiting for dinner to arrive. The terns, shouting their annoyance, continued the chase till the osprey passed beyond the island. "Unbidden guests are often welcomest when they are gone."

At other times the black-crowned night herons sitting on the dock would attract the attention of the terns. A few would be driven off, but the braver ones would remain, patiently ducking time and again as a tern swooped low. The terns soon tired of this and resumed feeding. Another bird not tolerated by the terns was a kingfisher. He, unhappy fellow, had but one recourse —to hide among the rocks and batteries.

Fishermen call the terns "mackerel gulls" and "bluefish gulls," for they indicate where the mackerel and blues are feeding. The terns feed on sand launces and other fish called spearing when the latter attempt to escape the larger fish below and swim to the surface. Thousands of launces were often seen milling about the pilings of the dock, trying to evade their enemies. To see flocks of 20, 50, or 200 terns feeding is an unforgettable sight. The contrast of black caps and gleaming white feathers, flashes of brightly-colored bills and feet, the seemingly effortless and marvelously graceful flight produce a never-to-be-forgotten picture. They fly over the water with heads bent, pause, hover for an instant, then plunge headfirst into the water. A moment later they reappear with a launce dangling from their bills, then vigorously shake the salt water from their feathers, and fly on in search of the next catch.

Plum Gut, the waters around Great Gull Island, and the Race are famous fishing grounds for striped and sea bass, as well as mackerel and bluefish. Near the dock a man caught 21 mackerel in less than an hour! Weekends and holidays, private and chartered fishing boats surrounded the island. Most were incurious or unaware of our presence. For them it was still a deserted island. The few parties that did come ashore turned back when we pointed out that the island was a sanctuary. All were most co-operative.

The threat of "shipwrecked sailors," mentioned by the crew of the "Noel," was fulfilled! We were finishing supper on the Fourth of July when we heard voices down by the shore. Upon investigating, we found two men, waist-high in the cold water, fighting to keep their sailboat, a "Pow Wow," from being dashed on the rocks. Because of winds and a strong current, they were barely able to secure the boat. By the time they had changed into dry clothes, a hot meal was ready. They told how they had floundered off Plum Island and how the storm had almost carried them past Great Gull and out to sea. It was only after we had all enjoyed a cup of coffee and some apple pie (which they had bought that morning in New London) that they thought to wonder what we were doing on an otherwise deserted island. Later that evening it cleared enough to watch some of the fireworks at

Ocean Beach, across the Sound; the storm had passed, and our guests were able to repair their boat and resume their cruise.

We collected plants and insects. While pressing the first plant specimen, one of the clovers, *Trifolium repens*, we discovered that it was a four-leaf clover, the only one either of us had ever found. Luck was with us! On August 13, 1949, Dr. W. T. Helmuth had made a survey of the island. He found no poison ivy, a fact that pleased everyone concerned. But unfortunately, twelve months later, it had become abundant in a few places. Probably the army had held it in check while they occupied the island. With the discovery of the common burdock, a scream rent the air. Catherine, unwittingly, had sat on the only plant.

▲ Miss Hussey enjoying a dinner of canned goods on an improvised table on the sun deck. Between bites, the girls could watch the wildlife around them

Hoping to lure the terns back to the island, the Committee had set out decoys in April in one of the two large areas that might again be suitable as nesting sites. By June the decoys were hidden by a dense growth of chicory and melilot, the two most abundant plants on the island. These plants were five and six feet high and harbored myriads of aphids, which were eaten by the redwings and song sparrows. Bumblebees, adult ant lions, wasps, drone flies, rose beetles, velvet ants, crickets, and ladybugs were but a few of the insects we collected by sweeping the plants with nets. The garbage pail yielded our largest specimen, a huge Green Caterpillar Hunter, *Calosoma scrutator.*

▼ Collecting algae and invertebrates on the rocky shores. The main objective of the expedition was to gather information that might further the development of Great Gull Island as a bird sanctuary

It was easiest to collect some insects at night, for then they came to us. The gasoline lamp placed near an open window made the room an excellent trap. "Wanted" specimens were killed in a cyanide jar, "unwanteds" left alone. Some of the latter managed to find their way out, but many became entangled in the webs of the spiders that shared our tower.

Of the few chores that had to be done daily, dishwashing was the most enjoyable. We did dishes once a day, at sunset. The two forks,

➤ Miss Hussey relaxes after a day's exploration. The tower was the only point at which the island could be viewed in all directions

plates, spoons, a knife, and one or two pans were placed in a pail and carried down to the dock where they were washed in the salt water. Sometimes it took an hour to do the dishes, for it was pleasant indeed just to sit and watch the day end. All too soon the beacon at Little Gull was turned on. In fifteen minutes, night would officially arrive. One by one the lights on the Connecticut shore appeared. As if by signal, the terns that had been feeding about the island began to leave. At first, one or two slipped away unnoticed. Soon groups of three or more departed. Before long a steady stream was passing by, very likely wending their way back to Plum Island, Gardiner's Island, and other nesting sites.

Many mornings we awakened to hear the foghorn at Little Gull blasting away at thirteen-second intervals. The tendency was to turn over and sleep some more. We rather enjoyed the fog, for, though familiar sights were blanketed, familiar sounds were uncovered. It was easier to hear the bank swallows flying overhead, to hear the Orient Point ferry go by, to recognize the different fishing boats by the sound of the engines, to hear the constant clamor of terns feeding, the far-off "quonk" of a black-crowned night heron, the splash of a lobster pot being lowered into the water, and the put-put of the motor starting up once more. Four lobstermen had pots around the island. We soon learned to recognize the varicolored markers bobbing on the waves.

The twenty-eighth and final day came all too soon. That morning, on a last tour of the island, we saw a young Common Tern sitting on a rock off shore. Tottering, rough-feathered, he was ignored by all but his parents. For us he was our biggest find—a promise for the future. One of this year's young might be the first to choose Great Gull Island as a nesting site another year. One factor that may prevent these birds from again nesting on the island is the so-called "weeds" that overrun Great Gull. Bindweed, rose brier, and particularly Japanese honeysuckle have become well established in some areas and will spread rapidly. These plants must be checked to some extent, because Common Terns prefer open places. To attract Roseate Terns, a certain amount of vegetation is desirable. For them, the small amount of beach grass, *Ammophila*, that we found might well be encouraged. The first week approximately 100 Common

➤ Pegging lobsters. The waters around Great Gull are famous fishing grounds for striped and sea bass, mackerel, and bluefish; but sportsmen were unaware of the authors' presence on the deserted island

and Roseate Terns visited the island daily; the last few days the number had increased to 400, with the Common Terns far exceeding the Roseates.

Today the terns are protected by law. Never again should there be the ruthless slaughter that once netted but ten cents per bird. However, protection from guns and souvenir hunters is not enough to ensure the safety of a colony. When the terns are again established, as we hope they will be, on Great Gull Island, a warden will probably be necessary to protect the breeding birds from the unmindful trespasser who, inadvertently, can disturb a colony enough to cause the birds to leave.

Luckily, the last day was a "weather-permitting" day, clear and calm, for we made the return trip in an open 20-footer. Our equipment was packed and waiting at the dock for the boat to arrive from the light station. Included were the collection of insects and plants, together with our notes, to be brought back to the Museum for further study. We piled in on top of our supplies and with some regret cast off. The only visible signs that we had inhabited Great Gull were the squares of newspapers showing in the broken windows of the tower.

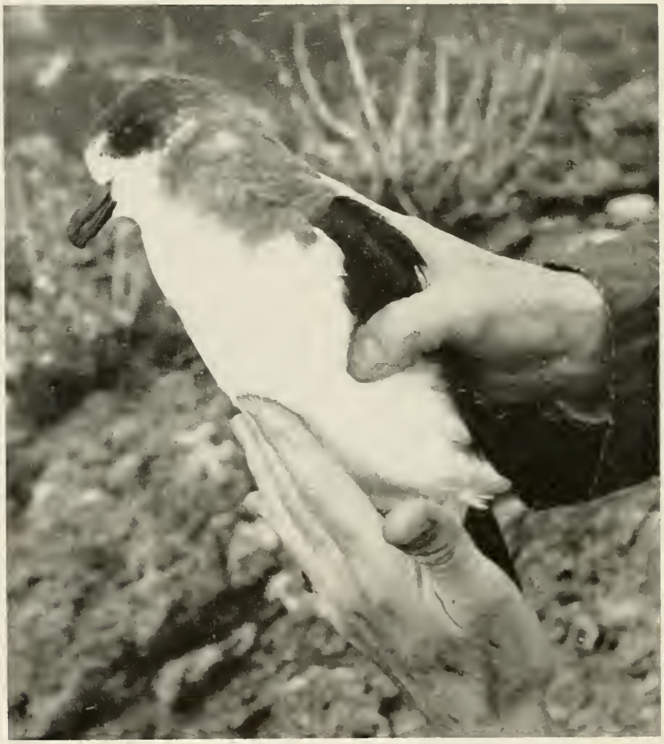
THE CAHOW STILL LIVES

Continued from page 156

pounded 30 feet below us, and now and then a swell would strike some undercut with a thud that made the whole island shake. No wonder that the soft, flaky limestone is falling to pieces! Then it began to rain, continuing at intervals all night, but fortunately, there was only one short period of heavy showers.

Cramped and weary, we remained at the first nest, except when one of us left briefly to exchange reports with Louis and David. Sometimes we dozed fitfully under a dripping poncho, until the sledge hammer of a wave would startle us awake. At frequent intervals we crawled to our burrow, turned torches down the tunnel, and watched the pair of cahows. The beam of light apparently created no disturbance. The birds could be seen nibbling each other's beaks and necks and then launching into an ecstatic turn-around in the small chamber, puffing up their plumage and shuffling about each other on bent legs. It was not possible to see whether one remained on the egg or whether the egg merely lay in the middle of the melee.

At 11:40 P.M., when the light was switched on the entrance of the burrow, one of the exquisite gray petrels was sitting quietly at the threshold as if ready to depart. The mates had thus remained together carrying on their connubial posturing and display for approximately three hours. As we prepared to make a flashlight photograph, the cahow at the door suddenly turned and retreated into the tunnel. Some time between then and midnight, however, it slipped away silently into the blackness. From then until morning no further activity was observed.



▲ A CAHOW just extracted from its burrow. The birds proved unexpectedly calm and gentle. When released, they returned promptly to the egg

A few days later we found a better way of inspecting a cahow's nest. We located a burrow eleven feet deep that ran under a massive limestone dome. By measuring with a fish pole, we found that the occupants and their egg were beyond the far side of the dome and that we could open the actual nest chamber with a prospector's pick. One bird retreated down the tunnel toward the entrance, but the other remained on the egg until we lifted it off, and unconcernedly resumed its task as soon as we had replaced it. The stone slabs were then shingled back so that the chamber became as dark as before and even more rainproof. It could be opened again with ease, however, and on March 2, after our return to New York, Louis Mowbray had the satisfaction of finding that the egg in this nest had hatched.

Louis, in his official capacity as Curator of the Museum and Aquarium, is adviser to the Government on many aspects of conservation. The Bermudian response to our findings was immediate and effective. Steps have already been taken to make sanctuaries of all the occupied islets and to give the cahows every other possible protection. The spacious nesting grounds of former times are, of course, permanently gone. The greatest present hazard to the cahow is the narrow margin of safety provided by its greatly reduced numbers, which are confined to small islets. The population is perhaps of the order of 100 adult birds. There may be fewer, but there are not likely to be more.

Unrelenting destruction of rats is a prime necessity. By spreading for a limited period baits poisoned with "Warfarin," the safe and complete elimination of rats would be feasible. If, in the meanwhile, the present nesting islets are kept secure, the larger insular stations, such as Castle and Nonsuch, may eventually become available for an overflow population of cahows from the smaller places. Under such circumstances the future of the beautiful and historic sea bird, which is a symbol of Bermuda alone, would be assured.

One of the questions invariably asked is, "How do you pronounce cahow?" Webster's Dictionary offers a choice—ca-HOO, CA-how —but we doubt its authority. After all, who has heard it from the mouth of any seventeenth-century Englishman who learned it, in turn, from the bird's mouth? Our cahows were unexpectedly silent. We can only interpret this as meaning that their garrulity dies away as incubation advances. Next November, when the mated pairs are full of song and courting and gusto, the birds themselves will surely tell us their rightful name.

LETTERS Continued from page 146

by T. Donald Carter of the American Museum's Department of Mammals:

Personally, I have had no experience with the effect of different chemicals on the porcupine, but I do know that wood dipped in or painted with creosote is distasteful to the animals and affords some protection. An aluminum-sulfate spray is used as a protection against rabbits and rodents, and this may also be effective. A preparation called Good-rite, Z. I. P., manufactured by the B. F. Goodrich Chemical Company, Cleveland 15, Ohio, is used with good effect to protect vegetation from deer, and it may work with porcupines as well.

Albinism in Robins

SIRS:

I have a specimen of a pure albino robin that has been stuffed by a taxidermist. Is albinism in robins very rare?

IOADELLE M. NOEL
Joliet, Ill.

Dr. Ernst Mayr of the American Museum's Bird Department comments as follows:

Albino robins are by no means a great rarity. We have several specimens in our collections, and reports of such birds are not infrequently recorded in the literature. Albinism occurs fairly regularly in some of our native birds, perhaps most commonly in the grackle, robin, and song sparrow. At least, these are the three species in which we see albinos most commonly. Perhaps this is only because they are common and occur near our homes.

Jumping Fox

SIRS:

About seven o'clock one morning this winter we looked out through the fog over the ice-covered snow in our back yard. We were startled to see a fox busily poking in and around the honeysuckle underbrush. Suddenly he started to run in circles, leaping high into the air over and over again.

Can you account for the actions of this animal? Do foxes catch insects when other foods are not available?

MRS. JULIUS R. SMAK
Fairfield, Conn.

The following remarks are offered by T. Donald Carter of the American Museum's Department of Mammals:

I would say that the fox was trying to locate a rabbit that was hiding in the honeysuckle. It is possible that the fox saw the rabbit enter, or he might have tracked the rabbit that far, or again he might have smelled or heard him. A fox will sometimes hunt a mouse in much the same way, but from the description I would say that the animal being hunted was of a larger size. A fox will often indulge in this form of hunting when his quarry is in grass so tall that he cannot see over it. He will also stand on his hind legs to look over the grass tops. Under similar circumstances, dogs will often jump in the same manner.

Foxes eat a great many insects, including grasshoppers and crickets. They are also fond of fruit.

Dwarf Domestic Fowl

SIRS:

In the October issue of NATURAL HISTORY Magazine, a question was raised by Mrs. J. C. Hageman, Lorain, Ohio, regarding the occurrence of dwarf individuals in birds. Although Dr. Zimmer has adequately answered the inquiry, I would like to add that dwarfism is known in the domestic fowl, and at least one dwarf breed is recognized, the Creeper.

The Creeper has shortened wings and legs comparable to the shortening of the limbs in mammalian dwarfs. As a result, the bird has a squat appearance and a peculiar gait. The trait is due to a dominant gene which is lethal to homozygous individuals, the eggs of such never reaching the hatching stage.

The common fowl, as well as other domestic breeds of birds, provide good hunting for those wishing to observe avian abnormalities. Under the more or less artificial environment in which they exist, many aberrant individuals survive, whereas in nature they would be swiftly eliminated.

ALBERT G. JOHNSON
Arnold Arboretum,
Jamaica Plain, Mass.

Indeed!

The Trumpeter Swan, once one of the rarest American birds, is now well on its way back to safety, in the opinion of U. S. Fish and Wildlife Service biologists. This conclusion is based on the fall census taken at breeding grounds in Yellowstone National Park and at Red Rocks Lakes National Wildlife Refuge in Montana. The count showed a population of 376 birds as compared with last year's 451, but there have been substantial increases in the number of birds seen in Alaska and Canada. This indicates that many birds hatched in the United States have reached the breeding age of five years or more and are re-occupying old breeding grounds in the north.

Practically all available breeding habitats in the United States were occupied by nesters during the past season, and very few suitable habitats remain. Nearly all of their former nesting grounds have been taken over by ranches, residential areas, airports, and oil wells. For these reasons, the trumpeter will never again become as common in this country as the smaller, less exacting whistling swan, although proper management and protection can save it from extermination.

Ewing Galloway photo

▲ TWIN whitetail fawns, one month old

A Dangerous Pet

You have often heard your state conservation department urge you to leave young wildlife where you find it. What can happen when you don't appeared in a United Press release.

According to this report, Mr. and Mrs. Seaton Barker, owners of a health resort near Colusa, California, adopted a fawn about four years ago and raised it on a bottle. All the neighborhood children made a pet of "Bambi," as the deer was called, and delighted in posing for pictures with their arms around the sleek neck of the now full-grown buck. Bambi was their playmate until a sudden change took place in his personality.

One day the deer was seen with blood on his antlers, and one Nick Miskulin was found dead near his car, his body trampled and torn by hooves and antlers. Later a posse shot the buck as it tried to break into an automobile in an attempt to reach two screaming women who had barely reached safety ahead of him.

What might have happened if this instinctive, seasonal aggressiveness had overtaken the deer at one of the children's photography parties is not pleasant to contemplate.

So leave young wildlife alone.

Announcing Sixth Annual High School Motion Picture Contest

Plans for the sixth annual national contest for the best school-made motion picture film have been announced. The contest is sponsored by the American Museum's Service Center in connection with the annual Audio-Visual Aids Institute programs.

The competition is open to all students of junior and senior high schools in the United States. The film must be 16 mm., planned and produced entirely by the pupils, and must not exceed 100 feet in length. A school may submit more than one entry but will not receive more than a single award a year. To enter the competition, the faculty adviser of the group of student movie-makers must secure an entry blank from the Museum, fill it out, and return it on or before May 15, 1951. The film must be sent to the Museum Service Center by December 1, 1951.

The selection of the winning film will be made by a panel of judges. In the event that five films come up to the standards of the Museum, an "Award of Merit" will be given for each of the films accorded second, third, fourth, and fifth places. Last year's "Oscar" was awarded to "Cat Anatomy," produced by students of Evander Childs High School, Bronx, N. Y.

Continued from page 151

lustrations give the work a significance that is much larger than the confines of the Sequoia National Park. The intelligent reader can learn from the type of ice sculpture found on Mount Whitney or Mount Russell, for example, the nature of the evidence that will enable him to read much of the geologic history of any glaciated mountain terrane. This is a work to be enthusiastically recommended to all who are interested in geology or in the high countries of the world.

H. E. VOKES

BIG HUGH
THE FATHER OF SOIL CONSERVATION

- - - - - - - - - by Wellington Brink

The Macmillan Co., $2.75
167 pp., 1 illust.

HERE is the first full story of the life of a great American. As a youth, Dr. Hugh Bennett became aware of what erosion was doing to the soils of his own community. Later, as a young man, he went on to study this problem throughout the continent. For years he made little progress, however, as both soil scientists and the general public were largely blind to what was happening. Finally, in the early '30's, the "dust bowl" made Dr. Bennett's point for him in a manner so conclusive that there was no further need for argument. In 1933, the Soil Conservation Service was created and Dr. Bennett was chosen as its logical chief. At last, with a government agency charged with the job of doing something about the loss of the nation's topsoil, Dr. Bennett was able to swing into action.

The success of this agency, which Dr. Bennett still heads, is a tribute to his sound understanding of not only the processes of soil erosion and its control but the psychology of rural people. Through demonstration projects, and later the astutely conceived soil conservation district program, the American farmer has been aroused to the need for action to check soil erosion.

It is no fault of Dr. Bennett or the Soil Conservation Service that only 18% of the job has yet been done and that the Service's essential land capability mapping program is still far from completion. Unfortunately, far too many Congressmen are willing to save dollars at the expense of America's most priceless and irreplaceable asset, its fertile topsoil. No enemy could do as great damage as we are doing to ourselves as long as we fail to heed Dr. Bennett's warning to apply soil conservation measures promptly to every acre of agricultural land that stands in need of it.

RICHARD H. POUGH

CAMELLIAS, KINDS AND CULTURE

- - - - - - - - - - by H. Harold Hume

The Macmillan Co., $6.50
271 pp., 76 illusts. (8 in color)

THE appeal of this interesting and authoritative work is chiefly to the camellia gardeners of the southern states and to those fortunate enough to own greenhouses. For such specialists Mr. Hume includes 70-odd pages of detailed descriptions of the numerous varieties of camellias, the majority of which are derived from six primary species. Especially interesting to the layman are the chapters dealing with camellia history. Through those pages we find wandering the shades of two early visitors to China and Japan. James Cunningham, a Scottish physician and employee of the East Indian Company, visited Amoy in 1700 and Chusen in 1702, where he secured plants and colored drawings of various sorts of camellias. Englebert Kaempfer, for whom *Azalea kaempferi* was named, was also a doctor. He was employed by the Dutch East Indian Company and in 1712 was stationed in Japan. The genus *Camellia*, incidentally, was established by Linnaeus in honor of another botanist, George Joseph Kamel. Also, the tea plant is a camellia! Camellias are natives of eastern Asia.

There are chapters on classification, propagation, soils, fertilizers, diseases, and greenhouse culture of camellias, to cite but a few.

The illustrations are mainly half tones, bound into the book in packets, as is today's bookmaking practice. In addition there are some line drawings, and several very fine reproductions in color appear at random through the book. There is a good index.

G. H. H. TATE

MEXICO IN SCULPTURE
1521-1821

- - - - Elizabeth Wilder Weismann

Harvard University Press, $7.50
224 pp., 169 plates

THIS excellent book deals with the sculpture of the Colonial Period in Mexico, which, as everyone who has traveled in Mexico knows, appears in tremendous richness and variety in the early churches and other religious buildings. Many must have shared my experience of having been charmed by the finer examples of this art yet overawed and confused by its quantity and the lack of any real guide to its meaning. *Mexico in Sculpture* provides the answer to much of my questioning. It informs me on how sixteenth century Spanish art combined with the native Indian tradition and then grew through the centuries into something new and unique. The significance of the story is not limited, however, to the history of sculpture. The author views her special subject as only a portion of the cultural whole and leaves one with a new understanding of the social conflicts engendered by the Spanish conquest of an alien civilization.

It is a serious, scholarly, and undoubtedly an authoritative book, written by someone who has been long absorbed in her subject. At the same time, however, the book has been designed in an extremely thoughtful and careful manner for the general reader. Its 167 excellent photographs illustrate the text with remarkable clarity. They are so carefully arranged within the book that the illustrations referred to in the text are almost always on the same or the opposite page, and one is not distracted from the course of his thoughts by the usual searching for plates. More detailed notes and references of interest to those wishing to enter more fully into the subject are grouped at the end of the book along with an extensive bibliography. In all, it is an exceptionally fine book, which should delight and inform a great many readers.

GORDON F. EKHOLM

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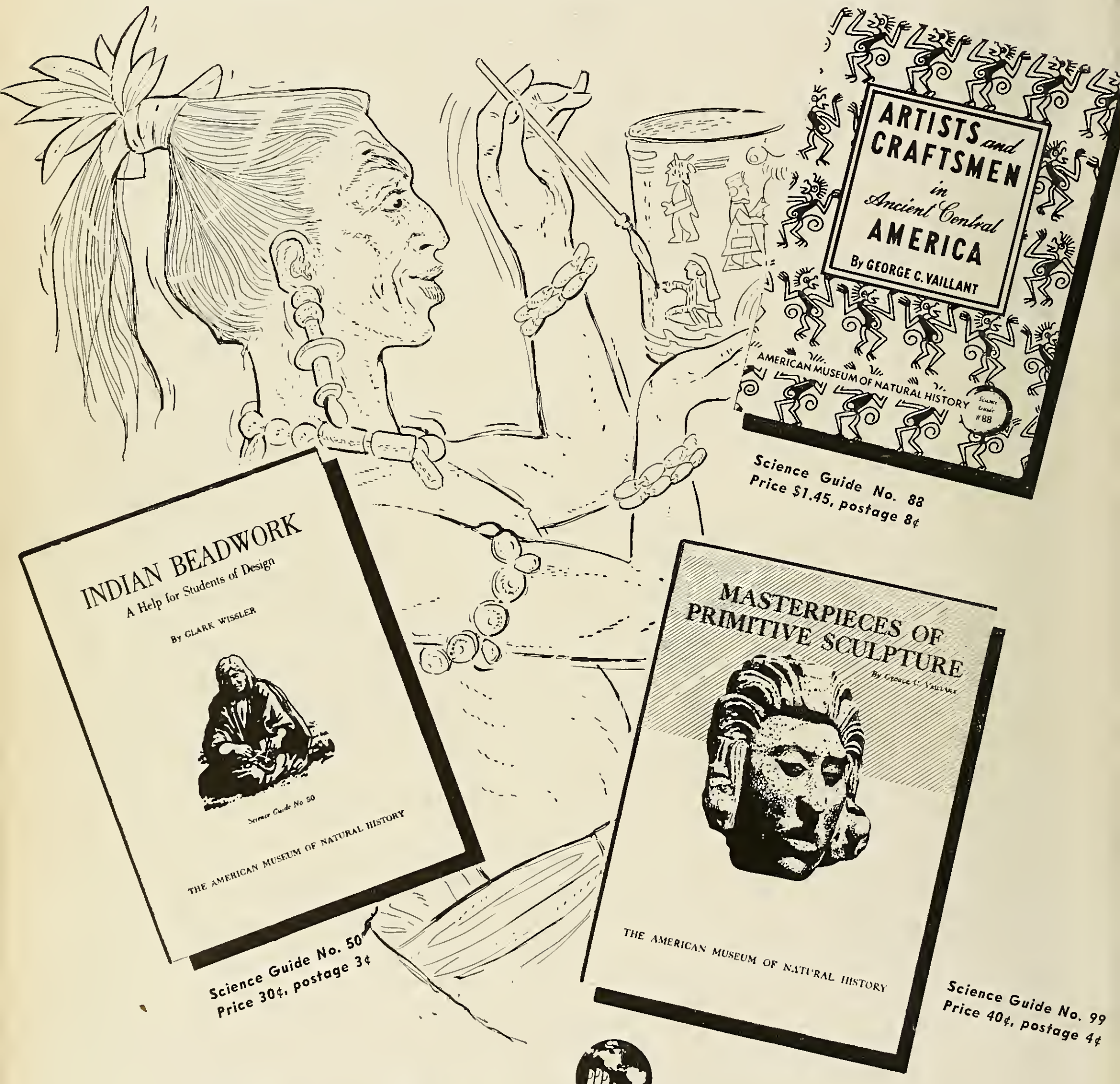
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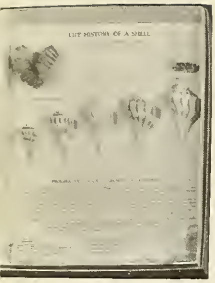
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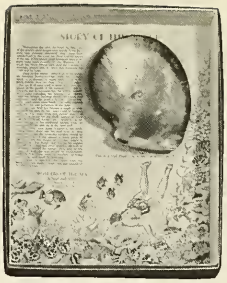
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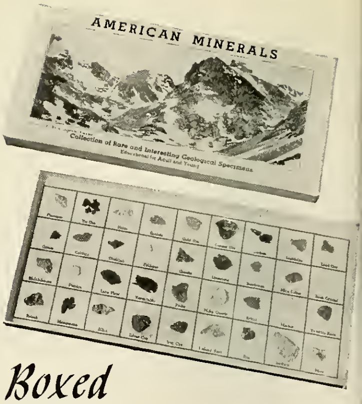
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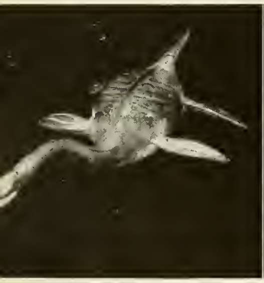

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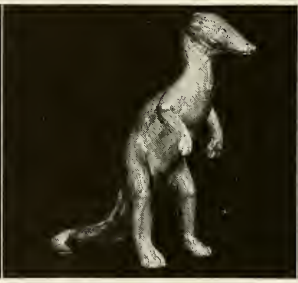

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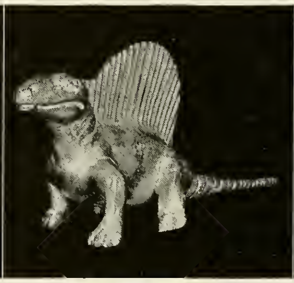

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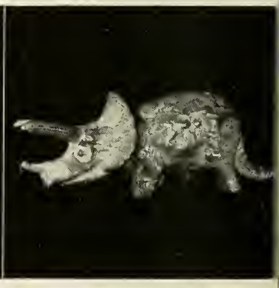

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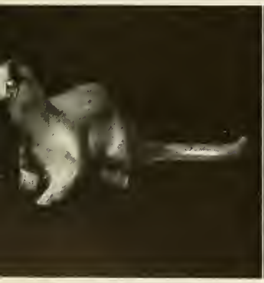

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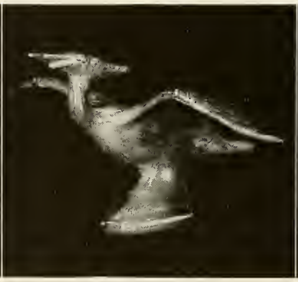

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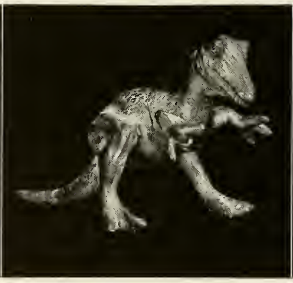

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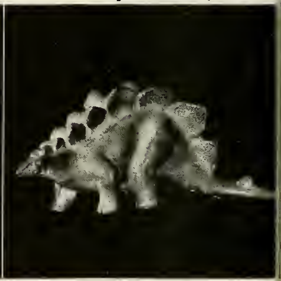

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FREEDOM and the Scientific Press

SEVERAL years ago on New York's lower East Side, a crowd gathered to hear a debate on rival ideologies. It was to be held in Labor Temple, an institution that through wars and social strife had stood as a symbol of Freedom of Speech. It had always been one of the few places where the little man as well as the big could be heard.

When the chairman tried to introduce the first speaker, the crowd voiced their feelings so strongly on both sides that he couldn't make himself heard. He waited and tried again but without success. Things began to fly through the air.

"Freedom of speech," he shouted, "is not freedom to drown out the other fellow. This place happens to be run by a church. That church probably doesn't agree with 90 per cent of what is said in this building, but it contributes about $50,000 a year to see that it *can* be said."

Silence fell. An orderly debate followed, and everyone went home the wiser.

Since that day, freedom of speech has been lost over more than half of Europe and Asia. With it went freedom of the scientific press.

How is freedom lost? One way is by the offer of a "new freedom"—freedom from responsibility. "Let the State do it for you," the argument runs. "Let the State decide what is better for you, and in return you will receive freedom from decision." This appeal to our sense of irresponsibility passes easily as a sort of Fifth Freedom. It has been one of the methods of tyranny from early times. It is no freedom at all. It is the Fifth Column against freedom. It is the short cut to slavery under the Super State.

Dictators and governments itching for total authority naturally seek control over science. Science is the search for new tools, new weapons, new ways of life. It is the total of man's efforts to push back the frontiers of ignorance and make a better physical world. Control of science means a subtle control over a large part of life.

Science cannot help humanity under the Super State. Human hopes cannot survive under it; no life is safe. Under the Super State, even a little child is a Thing.

So this is an appeal to you to cherish your right to know what science is doing and to decide what is a better life and what isn't. In NATURAL HISTORY, we try to give you the best in scientific truth through independent opinion. When you read what Jones says, it isn't Smith with his whiskers shaved off or Brown wearing dark glasses. It is someone who knows the subject, giving his honest belief. It is for you to agree or reject. You need not stop thinking for yourself.

Scientists in great heroism have fought for their right to seek the truth wherever it lies. Persecution equaling that of the martyrs has often been their reward. They choose to be the first by which the new is tried, and not a few have paid with their lives. Can you lightly hold the privilege their knowledge gives you? Be careful about handing it over to a self-styled expert.

Science itself is neither good nor bad. Scientific planning is necessary for the creation of a better hospital. But in Hitler's Germany, something that called itself scientific planning for population improvement produced the gas chamber.

Science itself is not the miracle. The miracle is the fearless will to use it well.

EDWARD WEYER, JR., *Editor*

LETTERS

Fish Movements

SIRS:

While watching small fishes kept in a large jar, I noticed that they rise and fall slowly without any apparent outside motion. Will you be so kind as to give me an explanation of how this happens? Do they take in air or water when they move down and expel it on rising?

MARIANO HERNANDEZ
Monterrey, N. L.
Mexico.

C. W. Coates of the New York Zoological Society offers the following comments:

It should be pointed out that fishes can move not only by means of their fins but also by means of the jets of water emitted from their gill covers during the course of breathing. Unpublished investigations have demonstrated that in the goldfish this water can be very nicely regulated both as to direction and amount, and that the fish apparently uses this as a means of making relatively minor adjustments in the three-dimensional space in which it moves.

Large movements are, of course, effected by the fins and the caudal portion of the body, the latter being the principal organ of forward locomotion.

We suspect, however, that your correspondent failed to notice the very slight and delicate movements of the fins in which practically all fishes indulge almost continuously, save when actually resting on the bottom. Since most fishes have almost the same specific gravity as water, being able to adjust the amount of gas in their swim bladder to accomplish this, it takes but very little movement of the fins to cause a change in position.

She's Without He's

SIRS:

"A Desert Walking Stick," by Lewis Wayne Walker, in the March issue of NATURAL HISTORY, intrigues me. Do walking sticks live only in the desert? About a year ago, as I took my car out of the garage, I found one right on my windshield. I realized at once that it was an animal and not a twig, for it moved and was just like the pictures I had seen of them. I carefully picked it up and placed it on a bush, where it then could not be distinguished from a twig. In all, it was about two and a half or three inches long. What was it doing in southern Louisiana, where this encounter occurred?

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Ewing Galloway photo

THE FRIENDLY CHIPMUNK *heralds warm weather and sunshine and crams its cheeks with proferred food*

The following answer is offered by Dr. Mont A. Cazier of the American Museum's Department of Insects and Spiders:

Walking sticks (Phasmids) are not confined to desert areas. As a matter of fact, they reach their greatest development in numbers, size, and form in the tropics, where some species attain a body length of from nine to thirteen inches. Many of the species mimic twigs, but in the moist tropical jungles, especially in the East Indies, they also resemble leaves. There are about 300 known genera and 2000 described species in the world. In this country, there are about seven genera and twelve species, all wingless except one species in Florida.

Although several species occur in Louisiana, one of the most interesting is the "Musk Mare," *Anisomorpha buprestoides* (Stoll). This insect has glands beneath the prothorax which exude a white fluid of a peculiar but pleasant odor. The specimen found in southern Louisiana by Mrs. Irwin might belong to this species, which is native in that area.

The walking sticks are strictly vegetarian and are usually found on bushes or trees. They move slowly, and one of their most striking accomplishments is that of death feigning. Development is rather slow, and it may require one and a half years to complete the life cycle. In most species both sexes are known, but in some the males have never been found, and these species reproduce parthenogenetically. In other words, the eggs are developed in virgin females without fertilization by the male. Scientists do not believe the males exist. In these cases, reproduction can apparently continue indefinitely without them.

Another Tropical Cry

SIRS:

If you will allow me a second question, it concerns the article "Poor-me-One," by William E. Lundy. When on the coast of Brazil not far from the jungle, and also in Manaos, I used to hear in the night something heartbreaking, which no one could identify. But instead of the cry starting high, it started low and went up and up and up, to a pitch so high that it reached the end of endurance. It would stop for awhile, then start all over again. To my way of interpreting the sound, it was like "swee, swee," etc. What was it? I heard it only in Brazil, never in Panama, Colombia, or Trinidad.

MRS. ANDREE DESBRIERE IRWIN
Madisonville, La.

The following remarks are offered by Dr. John T. Zimmer, of the American Museum's Bird Department:

Without being able to give an unequivocal answer to Mrs. Irwin's query, I

Continued on page 240

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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MAY, 1951

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Although the destruction they do may be exaggerated, you can effectively control them if you want to

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These "Enchanted Islands" support some of the oldest animals alive on earth

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THE COVER THIS MONTH

When the mule deer fawn senses danger, its head rises attentively and its huge ears swing around like radar antennae. Then it becomes obvious that the mule deer gets its name from these unusual ear trumpets. When it is older, its mulelike ears will be even more important in helping it to escape danger, for then its mother will no longer be watching closely over it.

Especially when the fawn is quite young, the vigilance and devotion of the doe are most admirable. With flailing hoofs she will viciously ward off menacing coyotes. During the day, she hides her fawn in a thicket and returns to suckle it in the early morning and late evening. After nursing, the fawn steals back into the protection of the leafy glade. The white spots on its coat blend with blotches of sunlight coming through the foliage and help to protect it.

The orphaned fawn on the cover was only two weeks old. It was raised on a bottle in the Jackson Hole Wildlife Park and then released.

Tom McHugh

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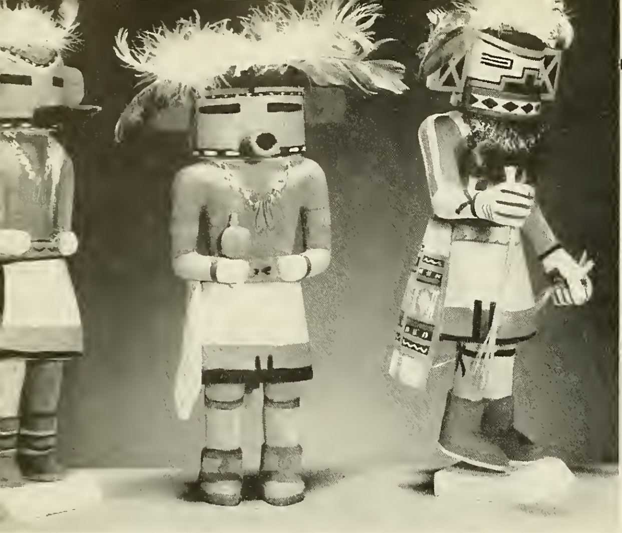

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By Harold S. Colton *140 pages, $7.50 plus .10**

This book explains the ways of identifying 250 Kachina dolls. It contains descriptions and ink drawings of their costumes, features, and symbols. Many superb photographs by Jack Breed, in color and black and white, add to this unique volume.

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The purpose of this book is to preserve and teach the Indian dances in their native authenticity. There are 27 photographs showing the dancers in full costume, and many ink drawings, so that one may follow and learn each step in the dances. This book will be helpful to council fire counselors, camp directors, dancing teachers.

THE BOOK OF INDIAN CRAFTS AND COSTUMES
By Bernard S. Mason *120 pages, $5.00 plus .20**

Revealing study of the crafts, costumes, and ways of life of different Indians. This book contains all the necessary instruction on preparing and assembling war bonnets, the making of various kinds of headdresses, anklets, moccasins, armbands, necklaces, rattles, drums, fans, etc. A great many graphic illustrations follow each step of the manufacture, and there are many black-and-white photographs of Indians wearing or using the finished product.

INDIAN ART OF THE UNITED STATES
By Douglas and d'Harnoncourt *200 pages, $5.00 plus .10**

A very complete work on the art of the United States Indians, which discusses and describes sculpture, pottery, weaving, embroidery, jewelry, pipes and toys, weapons, pictographs, murals, and sand paintings. Some color photographs and many black and white.

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INTRODUCING THE UNIVERSE

- - - - - - - by James C. Hickey

Dodd, Mead and Co., $3.50
154 pp., 18 illusts.

THIS well-written book presents a concise, over-all picture of the universe, of the planets, stars, constellations, and other physical objects that are to be seen in the skies. It also touches briefly on the forces that dispose of these objects and gives something on various theories that have been advanced to account for what can be seen and measured.

The text is directed at the layman, and it will be a wise selection for anyone who desires to obtain the basis for sky study. The author conducted a column on "Stars of the Week" in the New York *Sun* and is familiar with the type of information most commonly sought by the public.

The treatment is the logical progression from the nearest and best understood of the celestial bodies out into the uttermost reaches of space. The reader will frequently marvel at the precision of a science that can learn so much at such great distances. Certain problems always come to mind when a person puzzles over affairs beyond the limits of our earth, such as the presence of life on other planets, the origin of our earth, or how our world might come to an end. Discussions of such topics are practical and limited to such aspects as are supported by facts. There is no sensational speculation.

The book is well illustrated by half tones and has end-paper maps showing the constellations over the four seasons.

I believe a person with little or no knowledge of astronomy will understand this book readily, will acquire a better than average background by reading it, and will not find the process a dull chore of study. I also believe a reader who already knows enough to snoop around the heavens will find this book a handy reference and a helpful one to lend to friends who show an interest in the subject. It is not the sort of book that, once read, is laid aside and forgotten.

HAROLD E. ANTHONY

GENESIS AND GEOLOGY

A STUDY OF THE RELATIONSHIPS OF SCIENTIFIC THOUGHT, NATURAL THEOLOGY, AND SOCIAL OPINION IN GREAT BRITAIN, 1790-1850

- - by Charles Coulston Gillispie

Harvard University Press, $4.50
315 pp.

THE furor over Darwin's *Origin of Species* may be viewed as marking the end rather than the beginning of an intellectual revolution. One, at least, of the basic issues had begun to appear before the end of the eighteenth century and had been fought through in the science of geology before Darwin's work transferred the battleground to biology. The issue was not, Gillispie shows, so much one of religion versus science as of religion *in* science. Until this issue was joined, no real separation between science and religion was commonly recognized. Science, as "natural philosophy," found the workings of Divine Providence everywhere in nature. Religion, in "natural theology," argued for a materialistic approach to God.

The modern science of geology arose through two great controversies: first between "neptunists" and "vulcanists" and then between "catastrophists" and "uniformitarians." Most of the disputants on both sides considered themselves pious men working for the glory of God. Yet in each case one school (neptunists, catastrophists) was more amenable to then orthodox theological interpretation than the other. Probably the most basic issue was not denial of the Creator, Whose existence no reputable scientist then questioned, or even the literal interpretation of the Bible, although this point was argued. The question was, rather, whether the Creator has continued providentially to intervene in the operation of His universe.

That God has thus intervened was the dominant view of both theologians and scientists until the nineteenth century. Yet the geological controversies finally established that this view is entirely untenable in the field of geology. (It had already become untenable in the physical sciences, and the last phase, centered on Darwin, was to make it untenable also in biology.) It became necessary to choose between three alternatives: to separate science and theology as quite different fields without common subject matter, to reject the well-established findings of science, or to change theology in accordance with science.

That is the theme worked out in considerable detail by Gillispie in the present book. Limitation of the scene to Great Britain is restricting, and omission of the period after 1850 is like leaving out the last act of a drama, but the result is a clearer focus and concentration on material less familiar than the Darwinian controversy. The book is well written, and, although strictly scholarly in tone and method, it should appeal to anyone sincerely interested in intellectual history.

G. G. SIMPSON

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THE MALAYS—A CULTURAL HISTORY

- - - - - - - - by Sir Richard Winstedt

The Philosophical Library, $3.75
198 pp., 8 illusts.

IN view of the scattered condition and the multilingual character of the sources, every student of southeast Asia and Indonesia will greatly welcome this synthesis of the cultural history of the Malays. The main chapters of the book cover such aspects as origin, migration and language, beliefs and religion, social, political, legal, and economic systems, literature, arts and crafts, etc. This gives some indication of the very wide scope of the study. However, there is a marked inequality in the treatment of the various subjects, a weakness this study shares with most of the other surveys of this area. Thus, although we are given a summary of Early Man in this area from Pithecanthropus and Meganthropus through Solo and Wadjak man to the mesolithic skeletal remains, this survey is rather sketchy, as is also the survey of the archaeology of the area, based mostly on the findings of Heine-Geldern, Stein-Callenfels, and other authorities. There is, however, a good analysis of the Dongson Culture. The physical anthropology of the living races is almost entirely neglected.

In contrast to most of the summaries previously published, the book is more strongly orientated toward historical considerations, not only in its emphasis on migrations but also in its attempts to trace the probable sources of single elements of culture. Thus, the shamanism of the Malays, which is so conspicuously absent from most of the other Oceanian peoples, is derived from the Mongoloid strain that penetrated also the physical make-up of the Malays. The hysterical condition underlying the institution of shamanism, in the author's opinion, not only prepared the way for later Sufi mysticism, but has been a motivating power in Indonesian politics. The clear recognition of the continuity of such a mental condition can, in fact, contribute greatly to a better understanding of even the present-day situation.

The historical approach of the author is also manifest in his minute dissection of various cultural elements into their original Malayan or Proto-Malayan layers and their later Hindu and Islamic additions. In this analysis he also offers delightful reading to the student of acculturation in an area which lends itself as few others do to such a study. And he does so without the theoretical burden with which so many other studies of acculturation are overloaded. Altogether, therefore, the book is an excellent introductory text for the student interested in this area.

ALPHONSE RIESENFELD

EASTERN BROOK TROUT

- - - - - - - - - - - - by Bob Elliot

W. W. Norton, $5.00
242 pp., 19 illusts., 3 in color

THIS is an excellent book on the speckled trout, the trout of our boyhood—the trout that is not a trout but a charr. Like the grouse, our brook trout cannot stand against the march of civilization, and with the deforestation and consequent warming of the streams, it has retreated to its last great stronghold in northeastern United States and Canada.

It is fitting, therefore, that such a fine work should be compiled by a State of Maine man. The author, an expert fisherman, has spent a lifetime in the study of and quest for the brook trout. He has acquired a fund of knowledge that is expertly set forth in his book.

To the probable disgust of the dry fly purist, the author points out that most of us have started our knowledge of fishing for the brook trout with the lowly worm, and with this in mind, he includes in his descriptions of the various methods of angling a treatise on worming for trout. To that fisherman who has not as a boy felt the lusty tug of a good trout on a worm rig, the sympathy of this reviewer goes out. Indeed, he has missed one of the great thrills of life.

There is an excellent chapter on flies, both wet and dry, as well as streamers and bucktails. There are lists of patterns and a compilation of the favorite flies of famous anglers. The author discusses places to fish in Vermont, New Hampshire, and Maine, as well as in the Canadian provinces. He also enumerates some of the western waters as they pertain to the brook trout. He intersperses the book with tales from his own experience on lake and stream, which season the more technical parts.

Rods, lines, reels, and leaders are talked about; and, believe it or not, there is an interesting chapter on the keeping and cooking of trout. This man is not content with getting you to catch trout; he stays with the readers until the final morsel is eaten before the dying campfire! This is a book for the novice as well as the expert.

F. WILLIAM RANDEBROCK

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MEN OF OTHER PLANETS

- - - - - - - - by Kenneth Heuer

Pellegrini and Cudahy, $3.00
160 pp., 28 illusts.

THIS book has a very challenging title which, unfortunately, raises expectations a reading does not satisfy. It would have been safer to call it "Life of Other Planets." There seems to be a basis for argument on the presence of life outside the terrestrial sphere but so little reason to include man (as most people will interpret the title) as an element of it that false pretenses exist from the start.

The author establishes a factual background for the heavenly body under discussion—the moon, the sun, or one of the planets—and then introduces life into an inauspicious environment by a species of wishful thinking which is in decided contrast with the meticulous precision expected of astronomers. His whimsical fancy is reflected in the illustrations of other-world areas which suggest either too much or too little, depending on whether you expect science or fiction.

H. G. Wells wrote good fiction about the life on other planets. Wells had no scientific data to prove his Martians existed; he created them out of his imagination. But he imposed the minimum strain on the reader's credulity by striving for plausibility, keeping within commonly recognized physical laws and assuming that the behavior of life from Mars would be consistent with human knowledge of vital processes. Another type of fiction woven about extraterrestrial life is the Buck Rogers comic strip sort, vigorous, dramatic, and bold in concept.

As opposed to the fictional treatment, there is the carefully considered statement that confines itself to the actual evidence for the existence of life on other worlds and balks at futile fancy.

The book under discussion cannot be catalogued definitely as good fiction or good science. It attempts a compromise and suffers in consequence. It has good science in it as long as the author sticks to pure astronomy; when he assumes to cover the biology of the heavens, he certainly leaves the reader "up in the air."

HAROLD E. ANTHONY

THE NATURE OF THE UNIVERSE

- - - - - - - - - - by Fred Hoyle

Harper and Brothers, $2.50
142 pp., 12 plates

IF you are capable of intellectual excitement, start reading this little book, and hold onto your hat! You will not put it down until you reach the last page, and when you do, you will have been whisked at breathless pace from one end of the universe to another and through endless eternity. You will have been given a lucid, brief, but (unless you are an astronomer) sufficient account of the structure of the solar system, the galaxy, and the universe. You will also have been given recent, mind-stretching theories to account for the structure and history (past and future) of the earth, the stars, and the whole of the physical universe.

Hoyle's book is being compared with earlier popular works of similar scope by Eddington and by Jeans. To me, those authors achieved nothing like the pace, boldness, and impact of Hoyle. His style is easy, conversational, and simple—almost deceptively so, for the simplicity overlies extraordinary complexity and subtlety of thought.

No qualification is needed in saying that this book is fascinating, but be careful not to let its fascination wholly overcome your judgment. Hoyle is brief and direct. He does not argue or discuss; he tells you. In fact, much of what he tells you is highly speculative and controversial. It is proper scientific speculation and theorizing, extrapolating from observations and accepted principles, but in spite of the positive presentation it goes far beyond what can be called established at present.

Much of the value of the book arises from its scientifically imaginative quality, but some clearer warning as to where fact ends would not have been amiss. Everything Hoyle says might perhaps prove to be so—but most of us (and probably Hoyle, too) would be rather surprised if it did. I find, for instance, that his conclusion that there are about 100,000 planets in our galaxy inhabited by something like humans depends on so highly tenuous a chain of unproven hypotheses and assumptions as to be only the barest of possibilities. But isn't it an exciting possibility!

G. G. SIMPSON

THE SHELL COLLECTOR'S HANDBOOK

- - - - - - - - by A. Hyatt Verrill

G. P. Putnam's Sons, $4.00
228 pp., 16 plates, 89 text figures

THERE has long been a need for an adequate handbook for beginners in malacology, and it is unfortunate that this book has fallen so far short of answering this need. Mr. Verrill's book is interestingly written, but it contains more misconceptions and errors than most books published on this subject since the early 1800's. The following examples of the author's curious concepts illustrate the character of the book. In the sixth line of Chapter I, Mr. Verrill puts all shells in the *order* Mollusca. The Brachiopoda have not been included with the Mollusca since the classic work of E. S. Morse in 1873. On page 88 he says: "Like the drilling shells, the Teredos have sharp, saw-like teeth in their proboscis and with these simple tools they bore into the hardest wood or even into soft rock with the greatest of ease." No Teredo, or any other bivalve for that matter, has teeth or a proboscis equivalent to these organs in a gastropod. The pallets, or "drills" as Verrill calls them, function as a plug to close the entrance of the burrow when conditions are unfavorable to the animal. They have nothing whatsoever to do with drilling. Mr. Verrill is the first to report Teredos living in soft rock. I would certainly like to see them.

In comparing bivalves and gastropods the author says, "the creature [gastropod] also possesses two pairs of tentacles." Such generalizations are misleading and entirely wrong. All of the *Prosobranchs*, an entire subclass of the Gastropoda, and all of the *Basommatophora*, an order of the Pulmonata, have but *one* pair of tentacles, and these groups contain the majority of the Gastropods.

Mr. Verrill again prints the old fallacy that "any pearl would be ruined by cooking." Boiling does not destroy the iridescence of the nacreous layer. Pearls produced by the common edible oyster have no nacre, and the fallacy undoubtedly arose from the fact that people found pearls in their stew and thought they had been destroyed by cooking when they were valueless in the first place.

In general, the chapter on "How to Make a Collection" is good and might prove stimulating to beginners, but it is certainly hoped that they will not use formaldehyde to clean or preserve any shells. Nothing could be more destructive to the shell.

The last six chapters of the book, which are devoted to the shells of different geographical regions, are so vague and generalized that they are almost useless.

The plates on the whole are good, but unfortunately no indication of shell size is given. Large and small shells are often illustrated in about the same size, a very misleading thing for a beginner who has nothing to go by. The text figures are in most cases rather poorly drawn and in several cases erroneous.

R. D. TURNER

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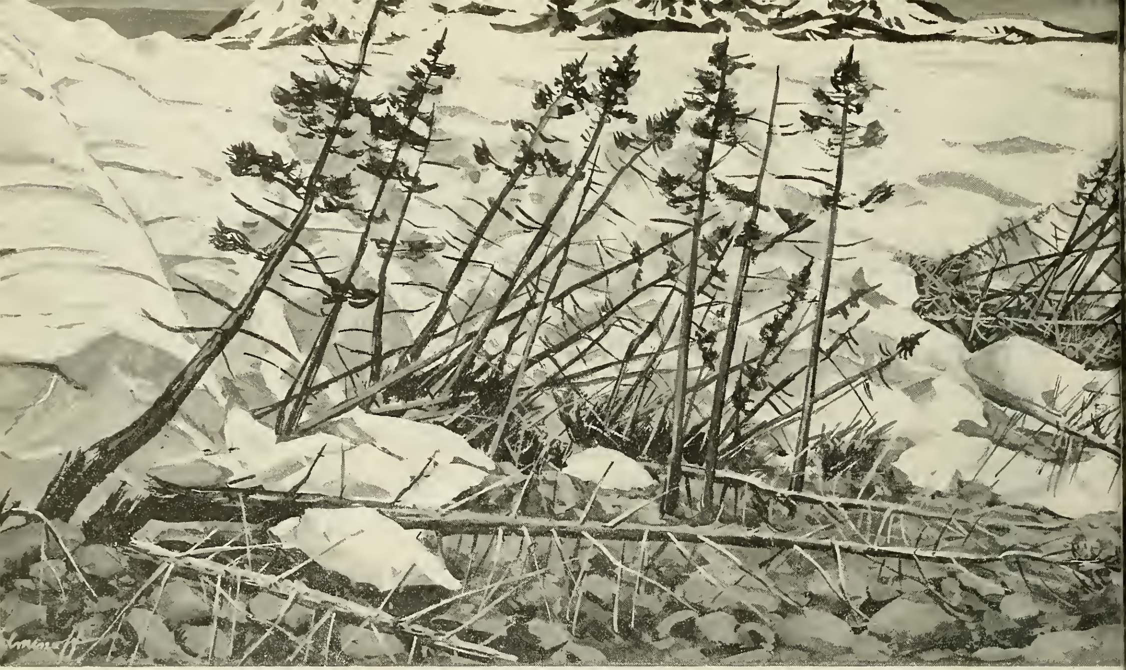


Pin-pointing the Past wit

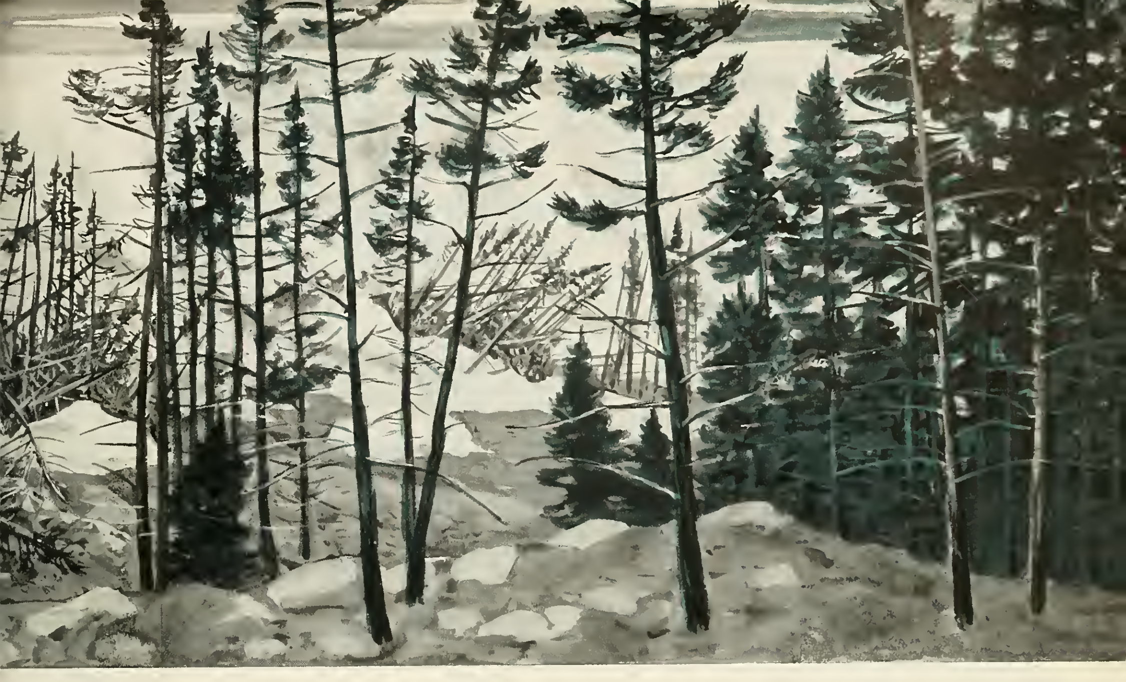
IN a Chicago laboratory a radiochemist stood before an oscilloscope connected to a Geiger counter. Across the oscilloscope screen, very much like the screen in a small television set, jumped a never-ending ribbon of green zigzags. The zigzags were made by the impulses coming from disintegrating atoms of radioactive carbon within the counter. The carbon had been extracted from a piece of wood, but the wood was by no means ordinary. In fact, it was a piece of very old wood, part of a spruce tree that grew in a Wisconsin forest so long ago that when the tree was alive the Ice Age still had northern United States in its chill grip. So long ago that mastodons and mammoths still inhabited the country in force. Indeed, it is quite possible that a mastodon, crashing through the spruce forest in the chill glacial air, brushed against this very tree.

The wood had been sent to the laboratory for an exact determination of its age—not the age of the living tree, which can easily be learned by counting its growth rings, but the time elapsed since the tree was alive. When a police surgeon examines a dead body, his medical skill tells him *about* how much time has elapsed since death occurred. But only *about*. He has no means of fixing the time exactly, even though the guilt or innocence of a person accused of murder may depend upon it. The surgeon can only look for certain signs and use his professional judgment.

Like the surgeon, geologists and archaeologists, trying to date the events of prehistoric periods, have only been able to look for signs and on the basis of them to make estimates which, although far better than nothing at all, are certainly not accurate. Some geologists, for example, had estimated the age of this particular spruce forest in Wisconsin at about 25,000 years, although they could not be sure.

The uncertainty, however, was being ended by the green zigzags that continued to jump across the oscilloscope screen. Radiocarbon, the cause of the zigzags, is a recent discovery that promises to make an accurate timetable of prehistoric events. It constitutes a kind of clock that set itself going when the forest tree died and that has been ticking ever since, at a known rate. The piece of wood was the latest of five samples, all collected from the same forest. When tested, all five gave answers very close to each other, and the average of them reads: 11,400 years ago—six times as long ago as the birth of Christ—and the date is probably accurate to within a few per cent.

This date is of tremendous importance to science, for it cuts earlier estimates and guesses more than in half and brings the extinct mastodons and mammoths (among other things) much closer to our own time than had been supposed.



▲ A GLACIER wrecking a forest in Alaska. The ancient catastrophe in Wisconsin dated by the radiocarbon clock must have looked the same, except that the ice cliff was far higher

he COSMIC CLOCK

One of the most revolutionary discoveries of the twentieth century illuminates prehistory as never before and brings Ice Age man much closer to our "back door"

By RICHARD FOSTER FLINT

Professor of Geology, Yale University

Drawings by Matthew Kalmenoff

Thanks to radiocarbon, we can look forward to the enjoyment of talking about prehistoric dates in figures that are almost precise.

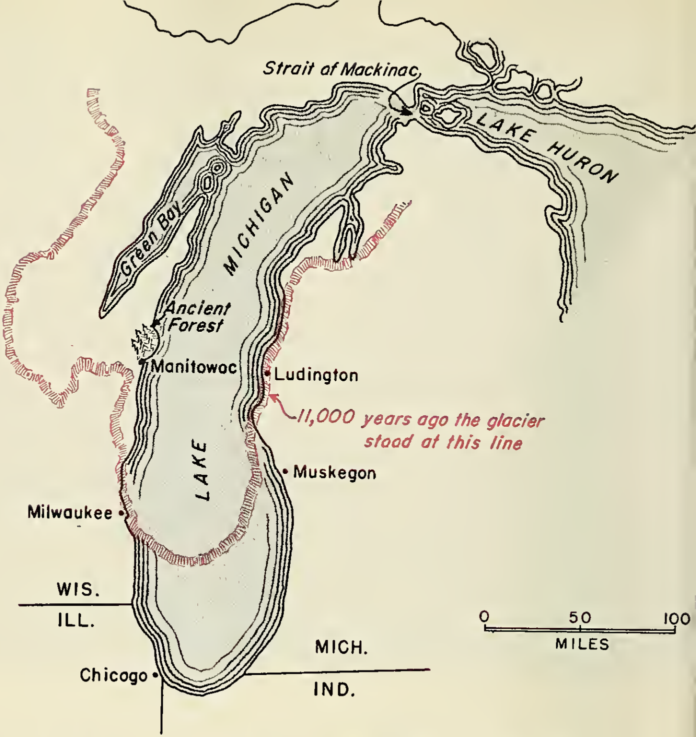
How this has been made possible is a story of research in nuclear physics and in chemistry, with important contributions from archaeology and geology. It is a story of co-operation among scientists, a pooling of knowledge in several fields. The pioneers in this unusual research are Dr. W. F. Libby and Dr. J. R. Arnold, and they did the work at the University of Chicago's Institute for Nuclear Studies.

What Is Radiocarbon?

The story of the research that has led up to this result shows the extent to which science has become integrated, with contributions from nuclear physics, chemistry, archaeology—and a few additions from geology, the field of sanitation, and antarctic exploration!

It all grew out of research on cosmic rays. These are great streams of neutrons that pour in to the Earth from outer space. They bombard the Earth's atmosphere and set up a sort of chain reaction that showers cascades of particles down through the air to the Earth's solid surface, where their arrival is pictured on the oscilloscope screen.

Many of the invading horde of neutrons, penetrating the Earth's atmosphere, collide with atoms of nitrogen, of which the atmosphere is largely composed. When one of these high-speed collisions occurs, a new nucleus is created. This disintegrates, emitting in the process an atom of a newly created element, Carbon 14. In this way great quantities of Carbon 14 are created, miles above the Earth's surface, like sparks struck by an impact. Like sparks, too, the Carbon 14 atoms do not last long, for they are radioactive, and they destroy themselves through spontaneous disintegration. Carbon 14 is "heavy" carbon. It is "heavy" because, whereas ordinary carbon has an atomic weight of 12, the weight of the new carbon is 14. The new carbon isotope is familiarly called, by the



scientists who study its characteristics, *radiocarbon*.

Although radiocarbon atoms may not last long, still, while they do exist, they get around. The first thing they do is combine with oxygen to form carbon dioxide. This mixes with the ordinary carbon dioxide that contains ordinary carbon and in the course of time becomes evenly mixed throughout the air that surrounds the Earth's solid surface. Wherever we may be, as we breathe we draw into our lungs heavy carbon in this form.

That doesn't mean, though, that radiocarbon is very abundant. Actually, for every trillion atoms of ordinary carbon in the atmosphere there is only one atom of the heavy Carbon 14! So, although we are constantly breathing "hot" carbon, its "hotness" is almost unbelievably faint, and we are none the worse for it.

The proportion of Carbon 14 to Carbon 12 in the atmosphere is believed to be constant. This should be so because it represents a balance between the supposedly steady rate of creation of radiocarbon and the rate of its destruction through its own disintegration.

Both plants and animals absorb carbon dioxide freely from the atmosphere. Probably, therefore, they contain just the same proportion of radiocarbon to ordinary carbon—one to about a trillion—that is present in the air. To be sure, the radiocarbon in plant and animal tissues is constantly disintegrating, but it is being renewed as constantly from the air.

A Calendar of the Past

This continuous renewal of radiocarbon goes on as long as the plant or animal is alive. But when death occurs—in a tree, for instance—the intake of atmospheric carbon ceases abruptly, and so new radiocarbon no longer comes in to replenish what is being continuously lost by radioactive disintegration. Thus from year to year the amount of radiocarbon present in the dead wood becomes gradually less.

The rate of decrease of radiocarbon is the same everywhere, and the rate is known. Because of this it is possible, by measuring the amount of radiocarbon left in the dead wood, to calculate the time that has elapsed since the death of the tree. Actually it isn't the *amount* that is measured; it is the *rate* of disintegration, which constantly diminishes and is always proportional to the amount of radiocarbon remaining. It is the tiny disintegrations—so many per minute per gram of carbon—that produce the green zigzags on the oscilloscope. The measurement is a tricky laboratory operation, one that must be watched carefully at every stage and that must be safeguarded against possible errors of several kinds. But thanks to skillful development, it works.

How the Calendar Was Developed

The radiocarbon calendar is the culmination of a long train of necessary research, without which the calendar would have no value. More than fifteen years ago it occurred to Dr. A. V. Grosse, radiochemist of the Houdry Process Corporation of Pennsylvania, that bombardment by cosmic rays probably was creating new radioactive elements. Later, this idea led Dr. Libby to believe that "heavy" carbon, created in that way, must be found in living matter. To test this theory, Libby and Grosse obtained from the Department of Public Works of the City of Baltimore a sample of sewage, a pure organic product. Analyzing it, they not only found radiocarbon in it; they also found that radiocarbon was present in just about the proportion they had calculated beforehand.

The next step was to make tests to see whether this same proportion of radiocarbon is present in living matter all over the world. So they obtained samples of wood from Chicago, New Mexico, Panama, South America, a Pacific island, Australia, North Africa, and Sweden and tested them for radiocarbon. This is a pretty good geographic distribution. But seashells (calcium carbonate) from Florida and seal oil specially collected by the Ronne Antarctic Expedition were tested also; and in the whole lot, radiocarbon proved to be present in the same proportion, within the limits of experimental error.

The success of these tests made it seem possible to take any piece of ancient wood or other carbon-bearing organic substance and determine its radiocarbon date. So it was decided to check radiocarbon against historical knowledge. The method was to determine the radiocarbon dates of pieces of wood and to compare these dates with the dates already calculated by archaeologists on the basis of historical evidence. This was done with a variety of samples, and the archaeologists no doubt had an interesting time selecting them. Two of these were pieces of wood from Egyptian tombs known to be about 4600 years old. The radiocarbon dates came out within 150 years of the historians' figures.

Although it was apparently true that the proportion of radiocarbon to ordinary carbon is uniform in all living matter, regardless of its location, and although the tests on Egyptian wood seemed to show that this proportion has been the same during the last 4600 years, this was not the end. For it was not yet proved that the same held true for still more ancient times, more than 4600 years ago. To prove this it would be necessary to test still older material. But there is one difficulty about all such very old objects. Their dates are unknown; therefore, they provide nothing with which to compare the radiocarbon dates.

There was only one thing to do: get radiocarbon dates for a large number of samples, collected from many different geologic and archaeologic deposits, compare them, and see whether the dates were consistent with each other. If they were, it could be fairly concluded that the concentration of radiocarbon had been very nearly constant throughout the whole period represented by the samples.

The selection of all these samples demanded the co-operation of a number of specialists. So the American Anthropological Association and the Geological Society of America were asked to name a committee of four specialists to collaborate with Libby and Arnold in the tests. As a result, more than 200 samples were collected and dated. Their ages ranged back more than 15,000 years.

The results were so generally consistent with each other as to leave little doubt that the radiocarbon calendar is reliable for dates as far back as it can reach. Unfortunately, however, its reach is limited, and for a simple reason. The rate at which radiocarbon disintegrates is comparatively rapid—so rapid that 5568 years after a plant or animal has died, the radiocarbon it contains is half gone. Although the rate gradually diminishes with time, still the proportion of radiocarbon remaining at the end of 20,000 years is so small as to make accurate laboratory counting very difficult. It is not likely that any refinement in technique will stretch the reach of the calendar much beyond 30,000 years.

Still, we must not ask for too much; during the last 20,000 to 30,000 years a great many things have happened, the dates of which science wants very much to know.

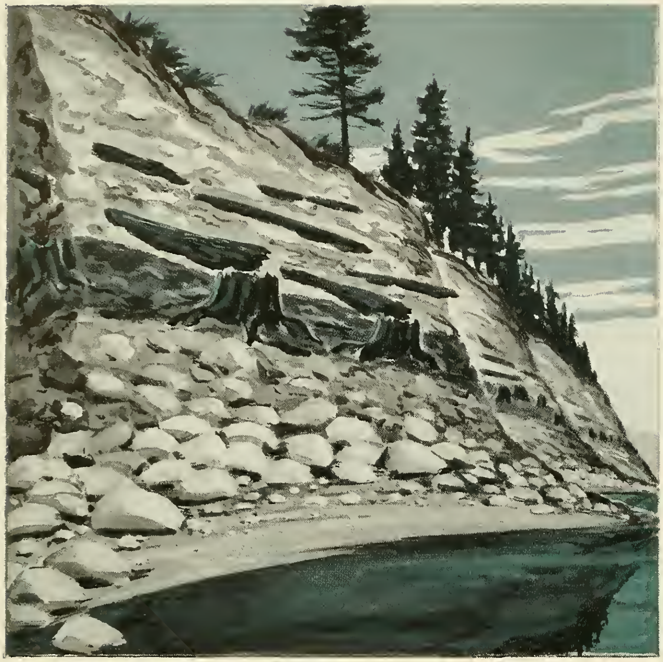
History of the Ancient Forest

At this point we can return to the ancient Wisconsin spruce forest from which we got the sample of wood we began with. The forest is buried beneath a thick layer of earth and stones plastered over it by the great glacial ice sheet that —not so long ago, as we have seen— flowed into the United States from Canada. Because of its burial, the forest would have been unsuspected if the ground had not been deeply cut into by the waves of Lake Michigan. In the course of time the Lake has created a bluff, or cliff, in which the ancient forest is exposed as a dark-colored layer of peat. Thanks to meticulous studies made by Professor L. R. Wilson of the University of Massachusetts, the peat has been described almost inch by inch. In it are spruce stumps still rooted in the ground beneath the peat. All the stumps are splintered. Many spruce logs lie in the peat or in the earth above it, all of them pointing southwest, the direction in which the invading glacier moved. Some of the logs are flattened, as though a great weight had pressed on them. Furthermore, their butts are splintered and twisted as only green, living wood splinters. From these facts it cannot be doubted that the trees were overwhelmed by the glacier, which snapped them off as a giant bulldozer might have done and then overrode the prostrate wreckage, smearing stony clay across its top.

When the logs were sawed through, they revealed confirmatory evidence. The oldest of the trees has 142 annual growth rings; so it is sure that the forest existed for at least 142 years before it was destroyed. The few outermost or youngest rings are closer together than the ones inside them, showing that during the last few years of their lives the trees were growing poorly. The reason for the poor growth is not far to seek. The upper part of the peat, unlike the peat layers beneath, consists only of mosses that live on wet ground or in water itself. The topmost moss plants are still upright, just as they grew, and their youngest branches are thin and scraggly. Water-laid clay overlies the plants and is packed around their stems, as could be the case only if it had been deposited while the mosses were still growing.

Clearly, what slowed the growth of the trees and what killed the mosses was a muddy lake, which must have flooded the spruce forest for several years before the final catastrophe. The lake could only have been created by the advancing glacier, which, by blocking the Strait of Mackinac, dammed up the water in the Lake Michigan basin and caused the lake gradually to rise. Meanwhile the glacier continued to flow southward, so that by the time our spruce forest had been standing in muddy water for several years, the moving wall of ice stood towering above it, ready to complete the task of destruction.

Following the track of this glacier, geologists have found the ridges of earth and stones that mark its outer limit only 25 miles southwest of the buried forest. They



After photos by L. R. Urlson

▲ **The Wisconsin logs** were exposed by wave action on the shore of Lake Michigan. Clearly the great glacier had snapped the trees off and buried them

have traced this outer limit nearly as far south as Milwaukee, and, on the eastern side of Lake Michigan, to a point between Ludington and Muskegon. Between Milwaukee and Muskegon the glacier formed a great tongue that projected southward.

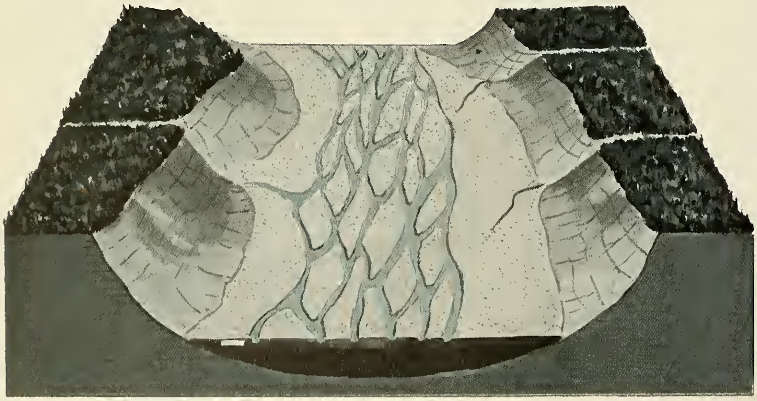
The radiocarbon calendar has given a date—11,400 years—for the destruction of the spruce forest. No buried wood has yet been found nearer than this to the outer limit of the glacier; so geologists have to resort, for the present at least, to their former method of estimating. From what is known about the rates of present-day glaciers, a reasonable estimate of the time required for the ice to flow from the forest site to its extreme and final limit is 400 years. Therefore we can say, provisionally, that the glacier stood at its final or "Milwaukee" line about 11,000 years ago, and from that line it began to melt away.

Matching Up Ice-Age Events

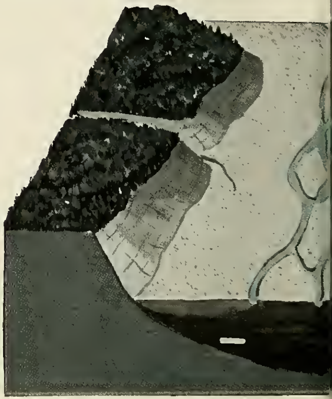
Away down near St. Charles, Missouri, close to the point where the Missouri River empties into the Mississippi, a group of geologists found, in 1949, a log of wood imbedded in the base of a terrace, the top of which stands 50 feet above the river. They recognized the terrace as the remnant of a deposit made when the Mississippi and the Missouri were choked with sand and silt poured into them by melting ice from the glacier hundreds of miles to the north. Gradually, the rivers silted up their valleys with these "melt-water" sediments, until in time their beds stood 50 feet or more above their present positions. Sediment 50 feet thick, filling a valley more than a mile wide through a distance of hundreds of miles, forms a very bulky deposit.

When the glacier melted away, it ceased to pour extra sediment into the big valleys. The two great

▼ **The St. Charles log**, far south of the glacier, fitted into the same story. Between 11,000 and 12,000 years ago, the river, choked with silt, had floated the log in and left it buried in the ever-increasing deposit



▼ **About 10,000 years ago** (*cente*
drawing) the river, still fed by th
melting glacier, had buried the log



rivers, no longer burdened with superloads of sand and silt, could then cut down into the thick sediments they had been obliged to deposit on their floors during the glacial invasion. With their great volumes of water they succeeded in flushing much of the accumulation away, but in protected places along the valley sides flat-topped terraces of sand and silt remained as witnesses to the former great fills of glacial waste. St. Charles is one of those places.

All this was apparent to the group of geologists as they examined the log projecting from the terrace sand. They realized further that the log must have been floated in and deposited as driftwood during the time when the river was choked with glacial sand. They guessed that the ice invasion was probably the one in which the ice in the Lake Michigan basin stood along the "Milwaukee line," straddled the Mississippi at Minneapolis-St. Paul, and stood in the Missouri valley at Yankton, South Dakota.

All this seemed probable, though it wasn't proved. But thanks to radiocarbon, several months later it *was* proved. A sample of wood from the log was sent to the laboratory, reduced to carbon, put into the counter, and the automatic counting was begun. Result: the log proved to be just a few hundred years older than the Wisconsin spruce forest. Clearly the choking of the rivers had begun while the ice stood somewhere north of the "Milwaukee line," before, but not long before, it overwhelmed the forest. Radiocarbon had proved a close connection between two events that occurred more than 11,000 years ago at places hundreds of miles apart.

For the group of geologists who were trying to decipher the history of the Ice Age it was a godsend. To have established by ordinary geologic methods even an approximate relation in time between the driftwood log and the buried spruce forest would have required years of difficult and painstaking measurement of the terraces along the Mississippi River between Wisconsin and Missouri.

Prehistoric Man in America

One of the important ways in which the radiocarbon calendar can add to the history of America is by dating the races of prehistoric man that lived on this continent thousands of years before the coming of white Europeans, and even before the arrival of the present-day Indians.

Since 1926, archaeologists had been finding evidence in western North America that Stone Age people once lived there. The evidence consisted of a peculiar kind of arrowhead, or rather dart-head, made of quartz and unlike any ever seen before. In contrast with the later Indian arrowheads these dart-heads had no notch at the base, but they did have a long groove down each side, and they were beautifully and delicately made. As the first ones were found near the little town of Folsom, New Mexico, they came to be called *Folsom points,* and soon archaeologists were speaking of the Stone Age people who had made them as *Folsom Man.*[*]

More Folsom points came to light. Implements of this sort were discovered in New Mexico, Texas, Nebraska, Colorado, Wyoming, Nevada, western Canada, and even Alaska. Furthermore, they were found in the same layers with the bones of an extinct kind of bison, larger than modern buffalo and quite different from them. Indeed, one point was found imbedded in the backbone of a bison—a bison that a prehistoric hunter probably killed to secure food and clothing. Clearly western North America had been the ancient hunting ground of a skillful and wide-ranging race of early Americans.

These discoveries led to all sorts of estimates of the time when the

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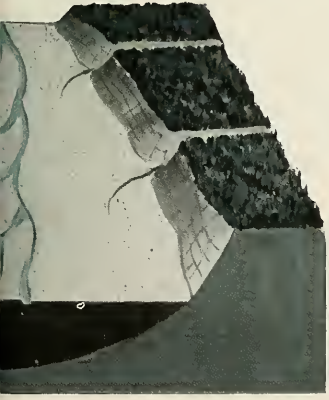
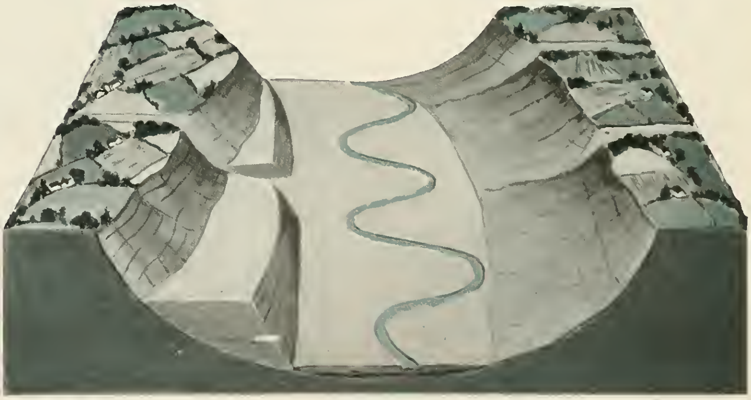
[*] See "The First Americans," by C. Bertrand Schultz, in NATURAL HISTORY for December, 1938.

ply. Scientists might never have nd this log had the river not nged from building to cutting



▼ TODAY, the river has cut down into the silt, leaving a terrace in the face of which the log was exposed. It was in this position that the geologists found it. The radiocarbon clock verified their deductions and gave it a definite date



Folsom people lived, but the estimates remained estimates — until radiocarbon came into the picture. A group of geologists and archaeologists in Texas, sensing at once that the radiocarbon calendar could solve the problem, searched for Folsom material suitable for laboratory use. At Lubbock, Texas, they found it: pieces of burned bone, the cold leftovers of a Folsom meal. Off went the collected and ticketed bones to the University of Chicago. There they were reduced to carbon, placed in the Geiger counter, and in due course the time since their animal possessors died was calculated. The radiocarbon date came out at 9883 years, with a possible error of less than 5 per cent.

Ten thousand years ago, then, in round numbers, Folsom people were living and hunting bison in North America. Ten thousand years ago was only a thousand years later than the time when the last big flow of glacier ice reached its outer limit at Milwaukee and Minneapolis and Yankton.

There is a good deal of evidence that the period when the Folsom people left their dart-heads and dinner scraps lying about was a period when western North America had more lakes, bigger streams, and therefore more rain than most of it has today. This is exactly what we should expect if most of Canada and part of the United States were covered with a thick ice sheet some millions of square miles in area. So the radiocarbon calendar shows that the evidence collected by geologists and archaeologists is consistent and illuminates another chapter in the ancient history of the continent.

With encouragement from the scientists at the University of Chicago, the complex laboratory equipment necessary for radiocarbon measurement is being set up at other research centers, among them Columbia and Yale universities. Radiocarbon dating is a slow, costly, and difficult operation, but the results it can bring to science may well become the twentieth century's greatest contribution to ancient history.

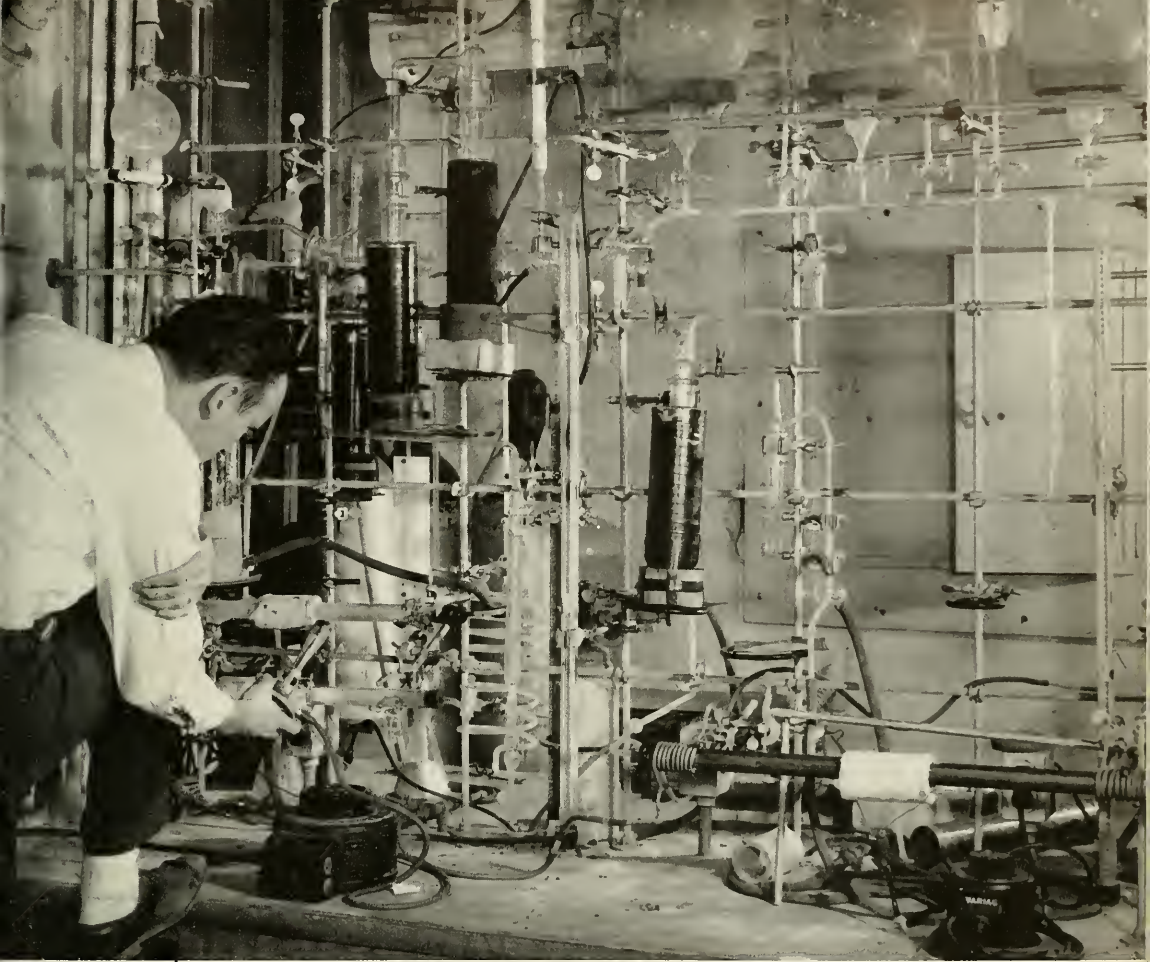
The COSMIC CLOCK – What Makes It Tick?

The instrument that tells the age of ancient samples fills all the popular requirements of a brain child of superscience, and it yields results that eclipse the promises of yesterday's visionaries

AMNH photos by THANE L. BIERWERT

IN the preceding article by Dr. Richard Foster Flint, the breathtaking implications of this new tool of science are dramatically discussed. Here the apparatus itself is depicted and explained for the first time in any popular magazine. The laboratories pictured are at the Lamont Geological Observatory, Columbia University, and are under the direction of Dr. J. Laurence Kulp, Geochemist.

Previously the antiquity of ancient bones, shells, and other organic matter—in other words, the very sinews of earth science—has



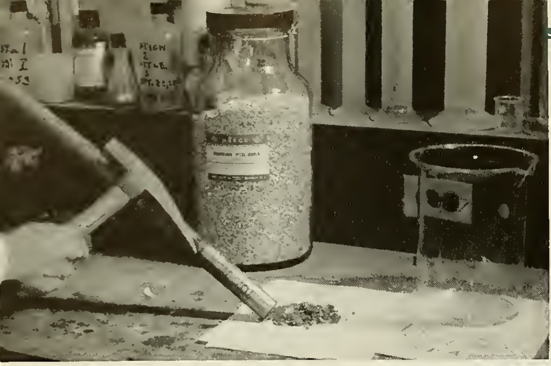
Dr. J. L. Kulp, of Columbia University, recording samples to tested at the University's laboratory at Palisades, New York. *ft to right:* clam shells that were buried by glacial mud; sea ater containing carbonate from two and a half miles deep; two eces of wood from a cave in southern Chile; a log from beneath bris of the mendenhall glacier in Alaska; and a whale vertebra und under twelve feet of volcanic ash in southeastern Alaska

▲ **Igniting a wood sample.** The carbon in the wood is converted to carbon dioxide, which is purified and stored in the large glass bulbs at upper right. The carbon dioxide is then brought down to the iron tubes at lower right, where it is reduced to elementary carbon by hot magnesium metal. By then, two days have elapsed since the beginning of the process. One trouble is that each test takes a long time. Also, the specimen is unavoidably destroyed

been at best an educated guess. For ages up to a few thousand years, estimates have been based on tree-ring studies and on seasonal changes in the thickness of sediments laid down by glacial rivers. Where methods like these failed, there has been no accurate chronology. So this is the first time it has been possible to date objects accurately up to 20,000 or 30,000 years.

The importance of this tool in terms of man's history during this time is hard to estimate. It probably presages the greatest single advance the science of archaeology has ever made. The information yielded by the Carbon 14 test is bound to revise many crucial dates in the complicated story of man's history.

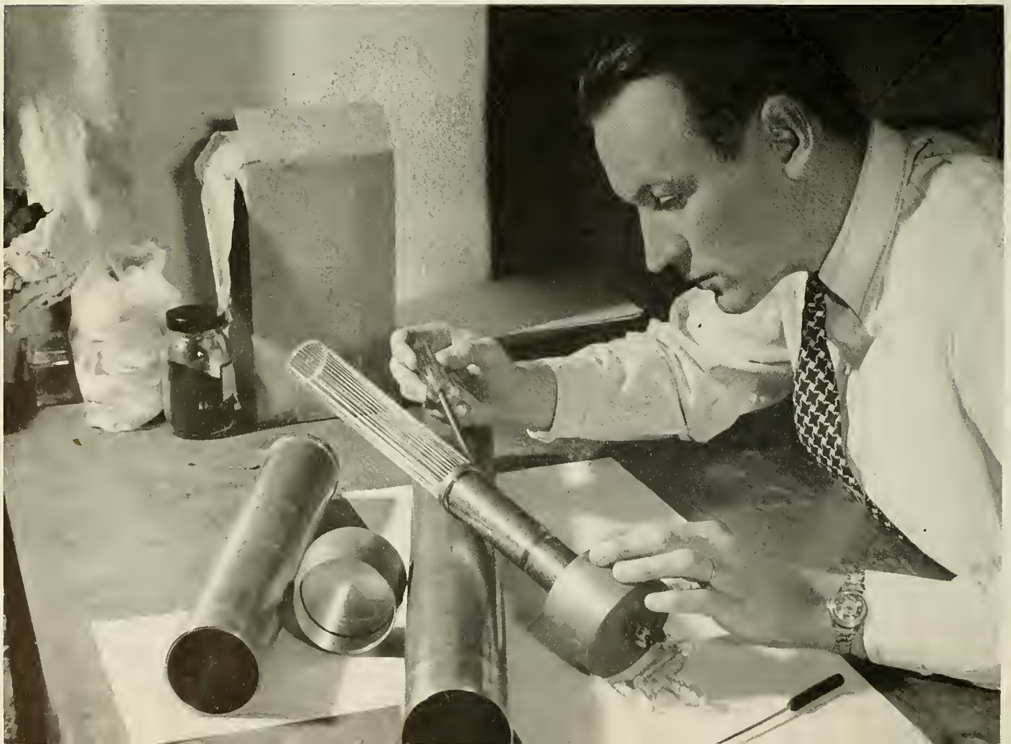
The peculiar radioactive species of carbon atom known as Carbon 14 is produced by cosmic rays in the upper atmosphere. It combines with oxygen to form carbon dioxide, which enters the tissues of plants and animals. The Carbon 14 atom differs from ordinary Carbon atoms (Carbon 12 and Carbon 13) only in that it is heavier and that it is radioactive. The radioactivity of Carbon 14 diminishes at a known rate. The instrument shown on these pages tells how much radioactivity is left in a given specimen, and this is a direct indication of its age.

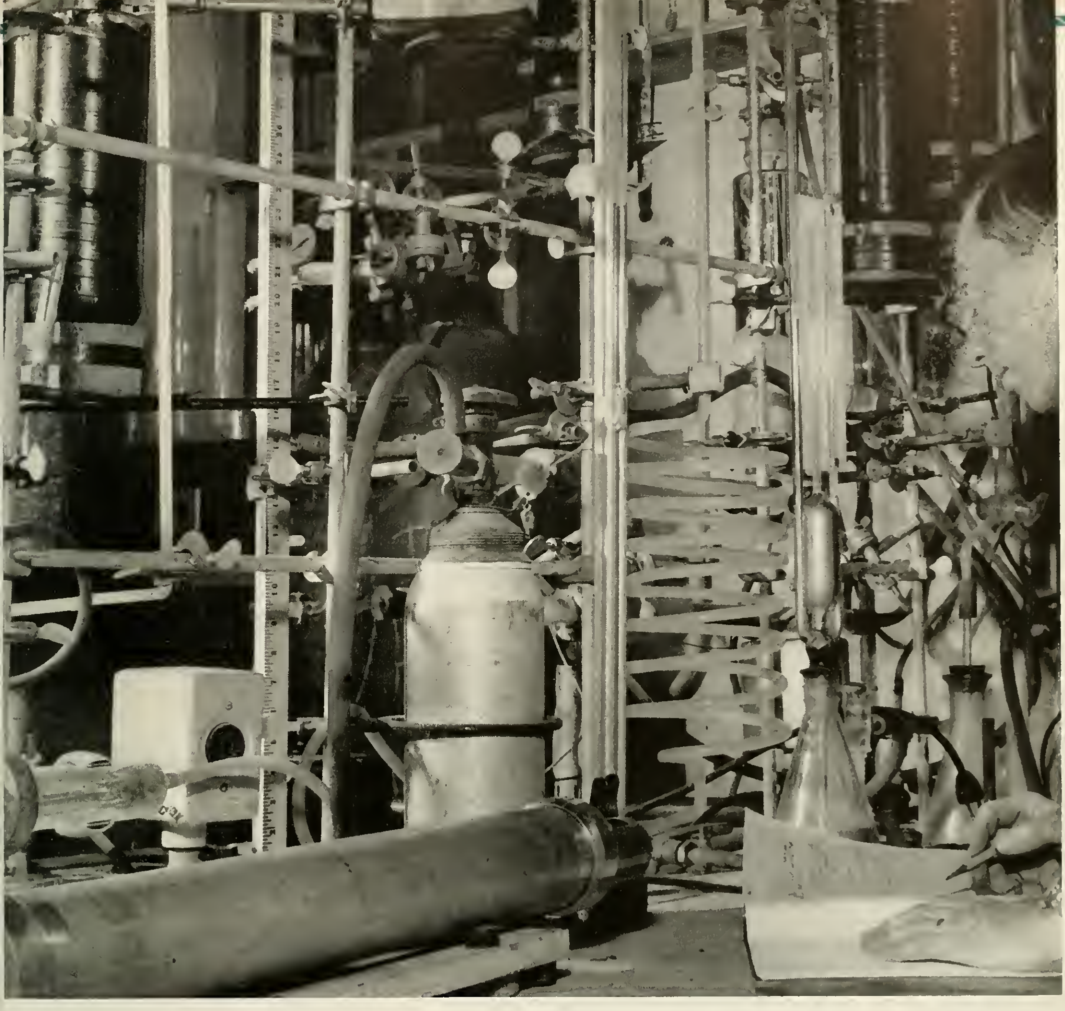


◄ Breaking the carbon out of the reduction tube. The carbon at this stage contains some magnesium metal and magnesium oxide, which are leached out by acid. The pure carbon is then dried and weighed

► The finely pulverized carbon is mixed with distilled water, and the paste is painted on the inside of one of the tubes. The other half, standing on the table in this photograph, is left clean to provide a "control" and is joined to the first. Dr. Kulp is here drying the carbon paste with an electric blower

▼ The sample tube at left is inserted into the cylinder in the center, and the insides of the Geiger counter *(above it)* are put inside both. Most Geiger counters use only one wire. This one has 33 for greater sensitivity, connecting the base of the unit with a ring at the end. These wires draw in the beta particles emanating from the Carbon 14 sample





➤ THE AIR IS exhausted from the tube by high-vacuum pumping. The tube is then filled with a mixture of argon and ethylene and is ready for the counting

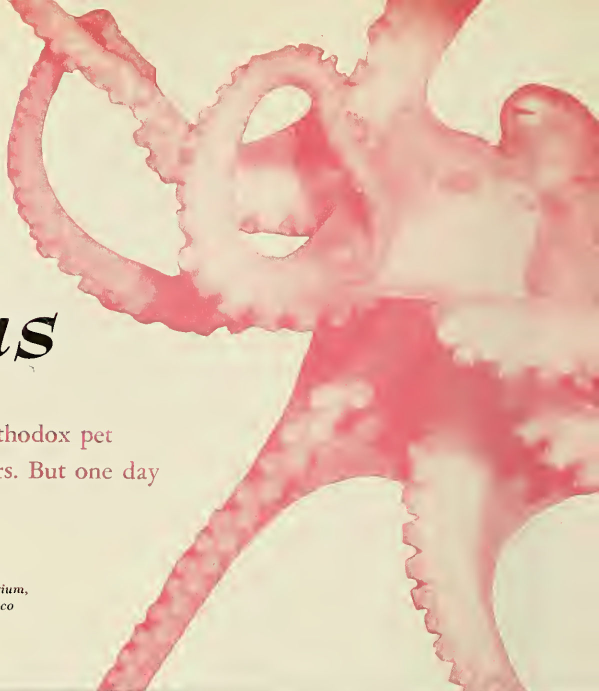
➤ PLACING THE GEIGER COUNTER containing the sample into the seventeen-ton chamber. The door weighs 600 pounds but rolls on steel cylinders at the touch of a finger. Heavy shielding is necessary to exclude the "soft" gamma rays, which would actuate the counter. Hard cosmic rays still penetrate the eight inches of iron, and these have to be filtered out electronically. The circular oscilloscope in the upper instrument shows both the hard and the beta rays. But the hard ones are filtered out so that the counter (between the two large dials) records only the beta rays. These tell the age of the sample

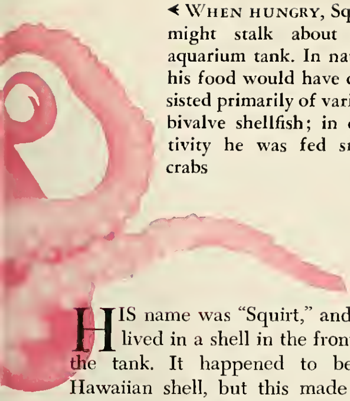
Friend Octopus

Squirt was a rather unorthodox pet who never ceased to surprise his keepers. But one day he got a surprise of his own

By Woody Williams

Photos by the author, courtesy Steinhart Aquarium, California Academy of Sciences, San Francisco





◄ WHEN HUNGRY, Squirt might stalk about the aquarium tank. In nature his food would have consisted primarily of various bivalve shellfish; in captivity he was fed small crabs

HIS name was "Squirt," and he lived in a shell in the front of the tank. It happened to be a Hawaiian shell, but this made no difference to the young octopus, despite his origin beneath an intertidal boulder in Southern California.

The name "Squirt" was almost the only one we could give him, for each move brought a squirt, each breath another. Sometimes it was a gentle squirt, to be sure, but at other moments it was a powerful stream as he dashed about the tank.

In the modern vernacular, he was jet-propelled — except that Squirt traveled in reverse gear. When excited, he would rocket up through the water, tentacles streaming behind. Then, suddenly, "bump"!— his rear end would smash into the aquarium, to remind him that he no longer had the freedom of the seas. At other times he would slither over the bottom, with the ends of his tentacles curling off the sand. Some kinds of octopuses are said to get up and toe dance on the tips of their arms, but Squirt didn't do this.

Perhaps you know that his jet apparatus, on the underside of his head, is called a funnel or siphon. It is generally used for excretion of waste products and water that has passed over the gills. When the animal swims, the funnel also produces a jet, pressure being built up for this purpose in the cavity beneath the mantle. Water enters the mantle cavity through another opening, which is then closed, and a strong muscular contraction of the body forces the water out through the funnel, causing the octopus to shoot backward. Squirt's relatives, the squid and cuttlefish, which have ten arms instead of eight, are even more adept at this method of getting about in the open sea.

Squirt's funnel also functioned in defensive tactics by laying down a smoke screen, whose dark brown coloring came from a so-called ink gland. G. E. MacGinitie, Director of the Kerchoff Marine Laboratory at Corona Del Mar, California, discovered that this smoke screen is not as simple as we might suppose. Besides offering concealment from the enemy, it destroys their olfactory powers. He found that the common shore octopus of Southern California, *Octopus bimaculatus* or *O. bimaculoides*, could paralyze the sense of smell of its major enemy, the moray eel, so that it required one to two hours in the laboratory for the eel to regain this sense. He noted that after an eel had been subjected to the ink, it would sometimes unwittingly nudge an octopus.

This ink is also a nuisance to people who attempt to keep creatures like Squirt in an aquarium. But we can say in its favor that it has left a permanent mark in man's culture, because the ink that comes from the ink sac of a cuttlefish is the source of the water-color sepia.

Still, I suppose Squirt had a right to show his temperament in an occasional blast of sepia, for he and his relatives boast the most highly developed nervous system of all invertebrates. He had, for example, a distinct brain protected by a cartilaginous case and connected with well-developed eyes. In fact, Squirt's sight was probably better than that of some vertebrates. Beneath the eyes were organs that were probably for smell, and buried in the brain case were two otoliths, or organs of balance.

The only degenerate portion of Squirt was his shell—just two internal vestigial chitinous rods. In the cuttlefish and squid the shell is more noticeable but not much more so. Probably the cuttlefish's shell, commonly called cuttlebone, is less important to the original owner than to caged canaries, who procure lime and salts from it. In the squid, the shell takes the form of a horny, pen-shaped structure. These "pens" are sometimes washed up on the beach.

Imbedded in Squirt's skin were remarkable pigment cells, which brought about a rippling change of simulative color over the creature's body as it moved from one habitat to another. Yet Squirt belonged to a species not as remarkable in this respect as some other octopuses. The octopuses and squids that have the best eyesight are also the ones that can change their color most rapidly and brilliantly.

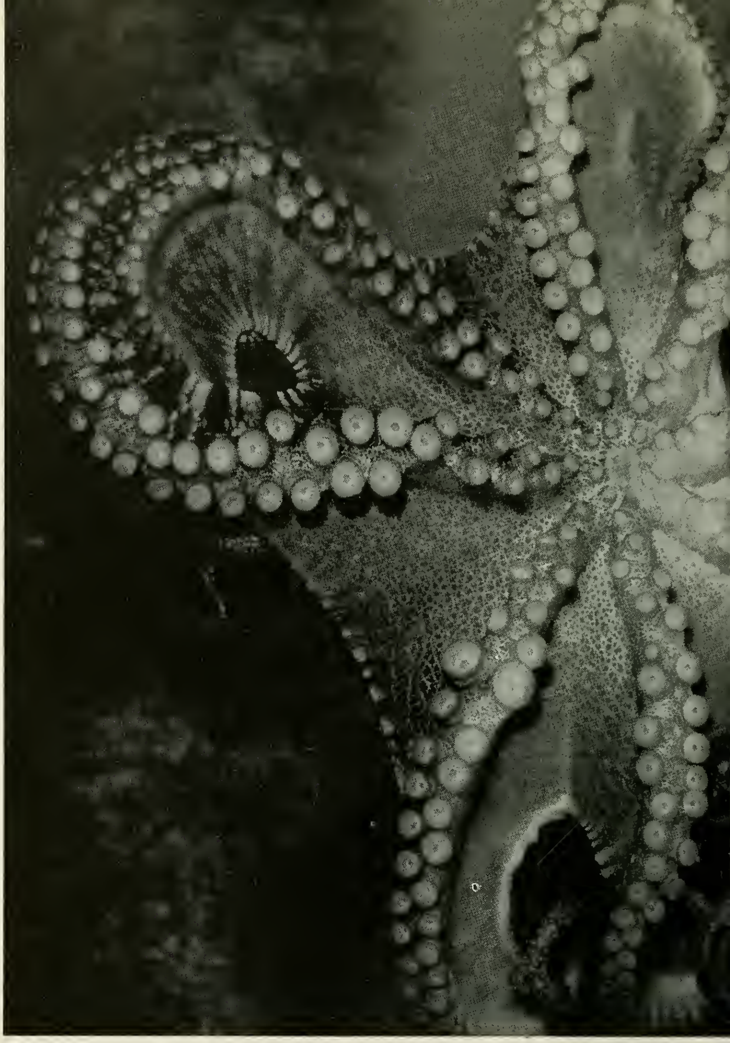
S. Stillman Berry, authority on Pacific cephalopods, suggests that creatures of this group, especially those in the depths, probably possess the most highly developed luminescent organs in the animal kingdom. Squirt, though, knew several tricks never described in the literature.

For example, one corner of the tank was uncovered, and he would climb up there and blast jets of water out onto the floor. Sometimes the stream would run across the glass top of the aquarium and down the front. My boss would then blame me for not cleaning the front of the tank, which had become obscured by the occupant's mischievousness.

Squirt had another technique for public concealment that was extremely efficient. He would duck into the Hawaiian shell and turn it over on top of him. The sign on the tank read *"Octopus bimaculatus,"* which was certainly not the name of the dead Hawaiian shell left face down on display.

In nature, Squirt would have lived mostly on scallops, mussels, and clams, plus an occasional crustacean; in captivity he was fed small crabs. He would dash out from the shell, envelop one of them in the web of his tentacles, and then dismember the luckless crustacean in a leisurely manner,

◄ OCTOPUS COUNTRY north of San Francisco, near Point Reyes in Marin County. Sometimes young specimens can be found by turning over rocks. Octopuses are popular food among California's Italians and Orientals



▲ Squirt's mouth can be seen at the cente of the arms, where the tentacles converge. The octopus and its relatives have the mos

like a tourist eating crab at San Francisco's Fisherman's Wharf. He would customarily crack the shell along the suture where it splits when the crab molts and then eat out the inside. He never crushed the shell as is sometimes supposed.

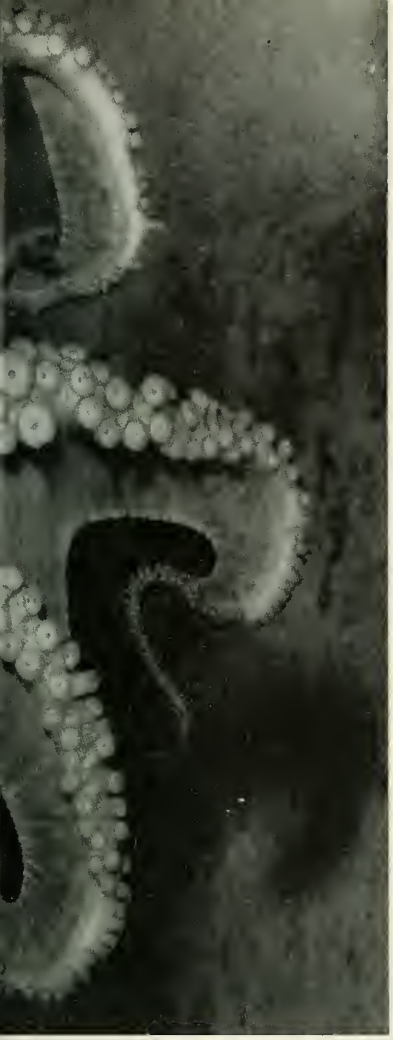
If you took the crab away from him soon after it had been captured, it would show no sign of bodily injury. It was just limp and dead. Squirt probably killed it with venom—not with his beak, which resembled a parrot's turned upside down. Squirt's relative, the common octopus (*Octopus apollyon*) of the coast of northern California, has been observed to spray its captive with venom. It didn't use its mouth for 20 minutes after the victim was dead.

In certain octopuses, this poison is toxic to man. In 1947, Don Simpson, collector for the Steinhart Aquarium in San Francisco, was bitten on the back of his hand while holding a specimen of *Octopus apollyon* for a photograph. The creature of one-foot spread left two small skin punctures on the back of the hand, which bled profusely. A few minutes later Simpson experienced a tingling sensation, and that night the hand swelled to obliterate the outline of his knuckles. Four weeks elapsed before the swelling disappeared.

In another authenticated case in Hawaii the venom produced dizziness in the victim, who had been fishing for octopuses on the coral reefs. He spent the most part of two days in bed, and there was some swelling and redness about the bite in the palm of his hand.

The kind of octopus Squirt was, however, has been found to be docile. G. E. MacGinitie tried time

▼ Originally Squirt came from the waters at La Jolla, near San Diego. He was the common octopus of Southern California, *Octopus bimaculatus* or *O. bimaculoides*



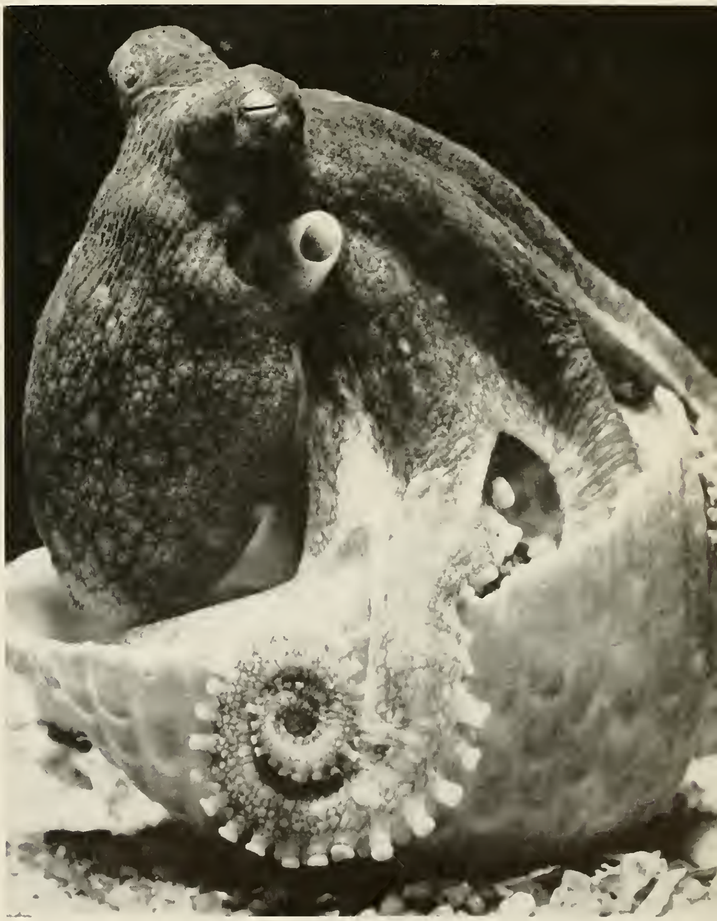
highly developed nervous system of all invertebrates, and they can probably see better than some animals with backbones

and again to get this species to bite him, but he never succeeded. Actually, for a very strange reason, we can't be absolutely sure he was working with the same species as Squirt. The prying curiosity of two biologists recently revealed a strange case of two distinct species of octopus that look exactly alike but live at different depths in the same area.

Adult specimens of what was then called *Octopus bimaculatus*, or the Two-spotted Octopus, were being studied at the Scripps Institution of Oceanography by Bayard H. McConnaughey. He thought they were all the same until he noticed that some of them were laying eighth-inch eggs (1.8-4.0 mm.), whereas the others were laying half-inch eggs (9.5-17.5 mm.). There were no intermediate sizes; a female either laid big eggs or small eggs.

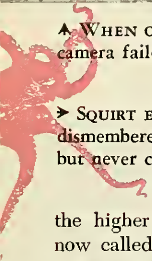
Grace Pickford of the Bingham Oceanographic Laboratory, who was collaborating in the study, then demonstrated that there actually were valid, small differences in the external anatomy of the big-egg and small-egg octopus but only in adults. Juveniles, like Squirt, were indistinguishable. And, to top the thing off, McConnaughey proved that different species of parasites called "mesozoans" inhabit the two different kinds of octopuses. So it is possible to tell whether a young octopus is one kind or the other. But because Squirt was very much a pet, we did not care to test this method by taking him apart to examine possible parasites. He may have been a large-egg octopus, which inhabits

▼ SQUIRT IN HIS HOME—a Hawaiian shell at the bottom of the aquarium tank. With his funnel, which protrudes from under the mantle, he could eject a smoke screen or propel himself backward through the water



▲ **WHEN OFFERED A CRAB**, Squirt would shoot from his shell so fast that the camera failed to stop the action, even when set at high shutter speed

➤ **SQUIRT ENVELOPED** the crab in the web of his tentacles and then leisurely dismembered it. He would customarily crack the shell to eat out the inside but never crushed it, as is sometimes supposed



the higher shore-line area and is now called *Octopus bimaculoides*, or he may have been the small-egg octopus, which lives in deeper water to an unknown distance offshore and retains the name *Octopus bimaculatus*. McConnaughey could not get the two species to interbreed, an additional evidence that they are genetically distinct beings. Probably the common name of Two-spotted Octopus will continue to be applied to both forms.

Squirt's sex was also a mystery. He may have been a she; but even in an adult Two-spotted Octopus, careful examination would have been necessary. The male uses one arm (the hectocotylus) to transfer a remarkable package of sperm, the spermatophore, to the female, where he usually places it under her mantle. Sometimes the tip of this arm is broken off and left with the female, the male being able to grow a new one. Observations indicate that Squirt's kind merely places the sperm under the female's mantle and then withdraws the entire arm. It is the third right one, and it looks like the others except for the minute and modified tip. This fact makes sexual identification difficult.

Maternal instinct is strong in the octopus. Dennis L. Fox, of the Scripps Institution of Oceanography, described a female Two-spotted Octopus that clung to her eggs even after the tank had been emptied of water. She remained in this position for fifteen or twenty minutes, resembling a "skinny-sac-like carcass." And W. K. Fisher, of the Hopkins Marine Station at Pacific Grove, observed *Octopus apollyon* to reject most of her food while brooding eggs from July through to October, which by then were only "dilapidated clusters of empty capsules."

Baby octopuses have to squirm their way out backward from the capsules, and W. K. Fisher, quoted in *Between Pacific Tides* by Ricketts and Calvin, tells us that "Once, in what might be interpreted as a flurry of temper at the difficulty of being born, one of the tiny animals discharged ink into the capsule."

Many sea serpent stories probably arose from the appearance of the tentacles of a giant squid swimming at the surface. The American naturalist A. E. Verrill reported that he measured a specimen from the North Atlantic that was 55 feet long and had arms 35 feet in length. MacGinitie estimated this creature to weigh 29¼ tons. Such arms, writhing along the surface, would undoubtedly produce a serpentine effect. A giant squid on the surface may not be a rare event. A tuna fisherman recently told me

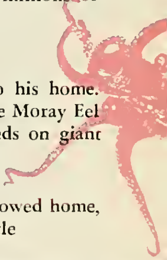
that he saw one of these monsters rise upward several feet above the water off the Coronado Islands near San Diego.

Verrill also mentioned the attack of one of these squids, *Architeuthis princeps,* upon two fishermen who came alongside to investigate a floating object in the water, which they thought to be a large sail or wreck off Saint John, New Brunswick. The account, an extract from a preacher's letter published in the Montreal *Gazette* about 1873, said, "On reaching it, one of the men struck it with his 'gaff,' when immediately it showed signs of life, reared a parrot-like beak, which they declare was 'as big as a six-gallon keg,' with which it struck the bottom of the boat violently. It then shot out from about its head two huge livid arms and began to twine them round the boat. One of the men seized a small ax and severed both arms as they lay over the gunwale of the boat; whereupon the fish moved off and ejected an immense amount of inky fluid that darkened the water for two or three hundred yards."

Evidence that these squids indulge in titanic deep-sea battles with the sperm whale, which feeds upon them, has been found on the bodies of captured whales. Marks of sucker discs as large as coffee cups, and large arms found in the stomachs of whales, indicate that even the marine giants live in constant conflict.

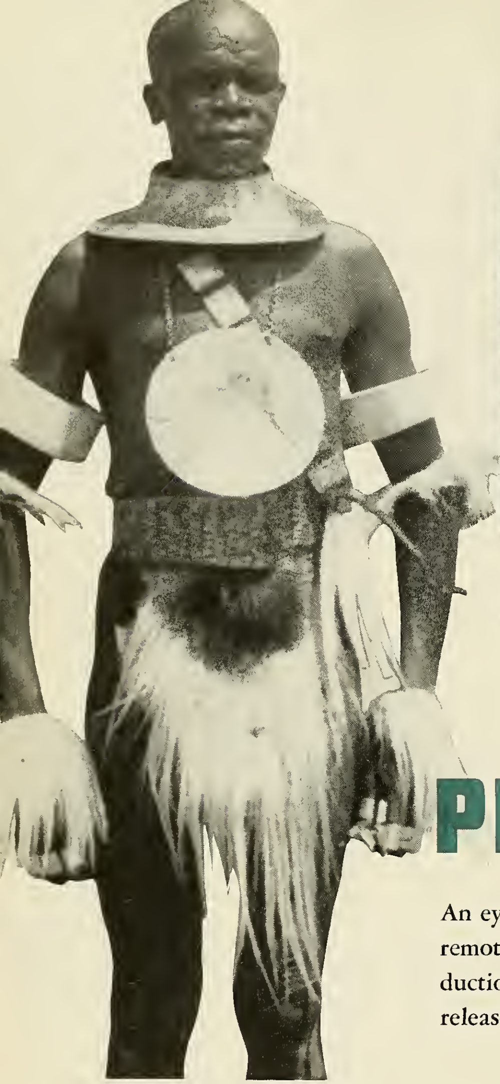
Yes, no creatures in the sea are stranger than the cephalopods. But like other groups, they also have their renegades or exceptions to the general rule, such as *Opisthoteuthis.* Not long ago this creature was taken off Eureka in northern California by the trawler "Andrew Jackson" in 188 fathoms. Beyond being new to science, which is not altogether uncommon for marine creatures, the animal had evolved in such a way that the funnel had been turned to point and discharge in a backward direction. This octopus was apparently jet-propelled forward instead of backward—unusual for an octopus, although squids can turn their funnel for propulsion in either direction.

However, either direction was of little avail to Squirt one day when an overly enthusiastic gentleman poked his cane through the front glass of the tank. The octopus slid into the corridor of the Steinhart Aquarium amid an excited throng. There was considerable confusion, but the poor creature was finally recaptured, and he lived for some time in a repaired tank, jet-propelling himself backward as most of his ancestors have apparently done for a good many millions of years.

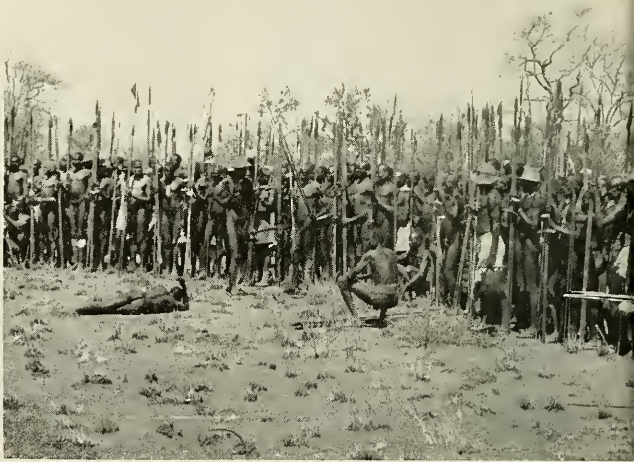


◄ A wrestling match ensues as Squirt drags the crab to his home. Cephalopods are preyed upon, in turn, by such creatures as the Moray Eel in Southern California and by the Sperm Whale, which feeds on giant squids in the deep sea

▼ When Squirt retired, he would ooze down into his borrowed home, but he always kept one eye alert through the loop of a tentacle



▲ A MALE DANCER, resplendent in ivory armlets and monkey fur



▲ MUCH OF their ceremonial life is directed toward success in food-procur activities. Here the "Father of the Land" lies on the hunting ground before spearmen and exhorts them to attack fearlessly and protect one anot

We Saw
PRIMEVAL MAN

An eyewitness account of the ceremonial life of Africa's remote Latuko tribe: vignettes procured during the production of a dramatic educational motion picture, whose release will be announced later in NATURAL HISTORY

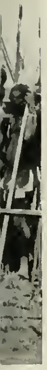
By EDGAR MONSANTO QUEENY
Trustee, The American Museum of Natural History

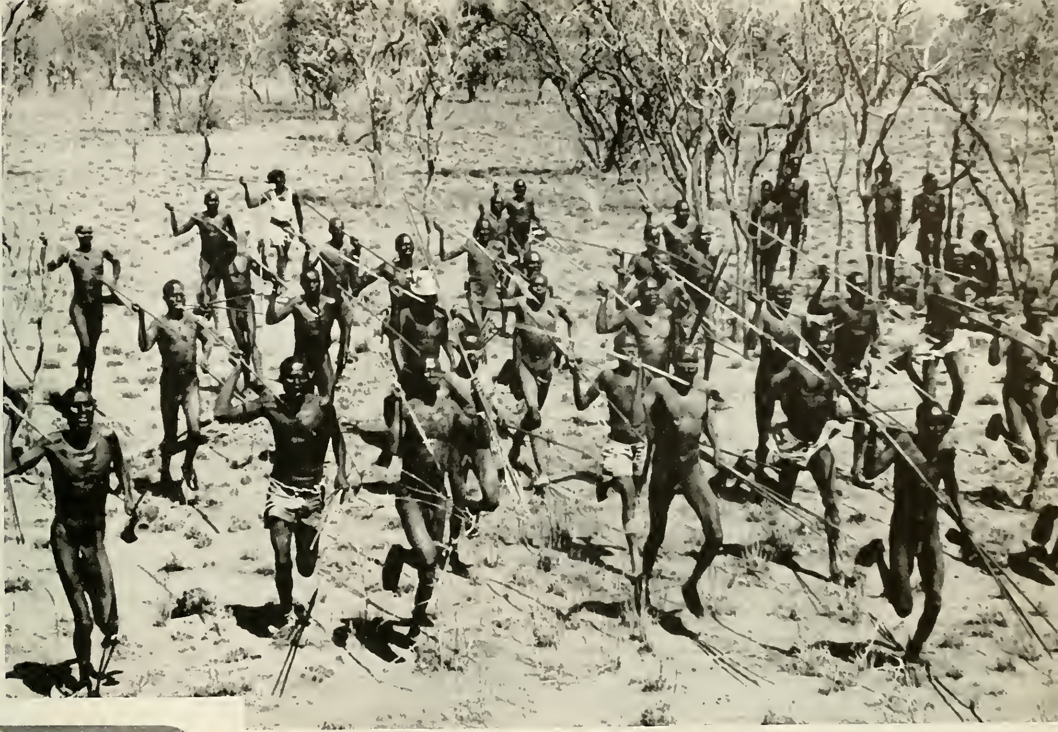
Photographs by Donald I. Ker

THE first white "men" to see the Latukos were a man and a *woman*. In 1863, that dauntless couple, Samuel and Florence Baker, spent several weeks at Tirangole—a Latuko tribal headquarters—while on the path to their historic discovery of Lake Albert. Fortunately, Samuel Baker was not only a great geographer and explorer but also a forceful author, who embellished his verbal descriptions with vivid sketches. His generous account of their stay at Tirangole permits the observation that little—very little—has changed during the 87 years that intervened before our visit. Hence, entering Tirangole was like raising the curtain on a play enacted by our own ancestors thousands of years ago. We looked upon primeval man—his industry, his witchery, and his violence.

Tirangole, which is but four degrees north of the equator, lies in the Sudanese province of Equatoria. It has a beautiful setting, nestling in a valley of flat open bush between the Imatong and Acholi mountains. Here, far away from our preoccupied world, both geographically and spiritually, dwell several thousand Latukos.

They are tall, well-formed people. The men's powerful Nilotic nakedness gleams under the torrid sun like polished bronze; the young girls, whose carriage and grace equal that of Powers models, wear





▲ **The hunters, brandishing spears in mock attack, assure the "Father of the Land" of their courage**

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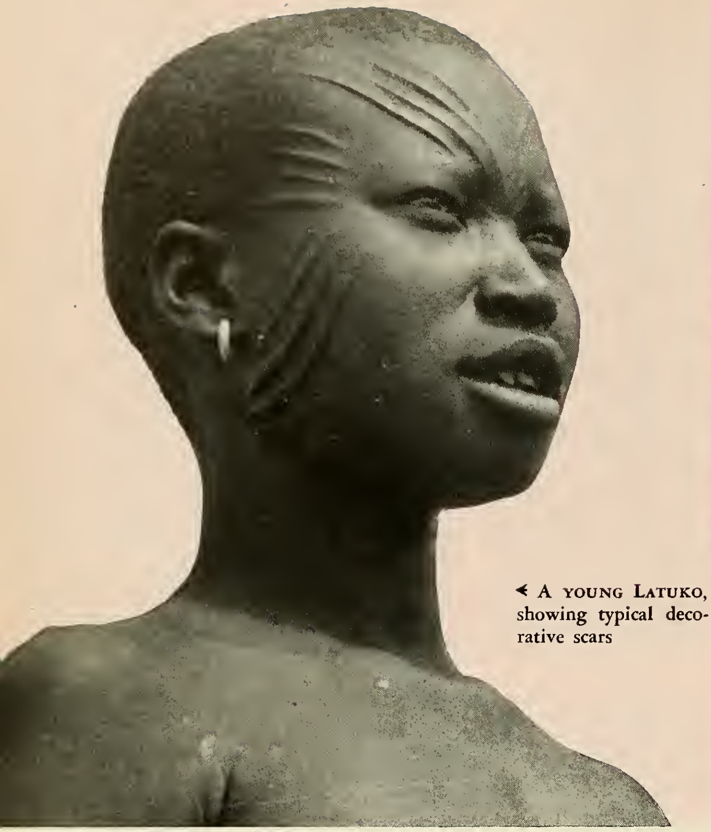
◀ **The author, identifying himself as the leader of an American Museum expedition somewhere in Africa**

only goatskin lappets, or aprons. Latukos are a courageous people, too. Their name was given them by the Anuaks, whose land they conquered. Latuko means "deaf men"; they did not understand when the Anuaks threatened. They are spearmen; their word for spear—*gor*—also means war. Until recently a Latuko boy was not considered a man until he had dyed his spear in an enemy's blood. Even today one seldom sees Latuko men outside villages without their spears. And in Tirangole one sees men with ornamental skin scars, or cicatrices, on their right shoulders, like lieutenants' bars, to indicate that they have killed *men;* such scars on left shoulders indicate that *women* were victims.

The spiritual and temporal head of a Latuko tribe is the *Kobu,* or Rainmaker. The office is hereditary and may be held by either man or woman. Tirangole's present Rainmaker—Lomiluk, a finely formed six-foot-four man—is the grandson of Moy, the reigning Rainmaker during Baker's visit. The British wisely administer the territory through Lomiluk.

Torit, some 30 miles distant, is the residence of the British District Commissioner, Mr. John Owen, and a headquarters of Equatoria's Defense Force. Although Christian missionaries have made some headway here, the Tirangole population is almost entirely pagan. It consists of members of the Iago clan. Their totem animal is the crocodile; they believe that after death the departed soul enters a crocodile's body. In addition to the beliefs surrounding the totem, Latuko spiritual life centers about rites, magic, and dancing, having to do chiefly with their food supply—their grain and their game. For instance, magico-religious rites precede their hunts.

Dry season is hunting season. Equatoria's annual rainfall averages some 36 inches, almost all of it falling between the spring and fall equinoxes. October through February, when the sun is over the Southern Hemisphere, constitutes the dry season, at the end of which all small rivers have vanished, the soil is cracked and parched, and its surface is a powder frequently swirled up to the heavens by gyrating dust devils. The grass is burned off, and from November through early



◀ A young Latuko, showing typical decorative scars

▲ Thirty miles beyond the adminis trative headquarters of the district, th expedition reached Tirangole, a settle ment practically isolated from the res

March game is given little peace.

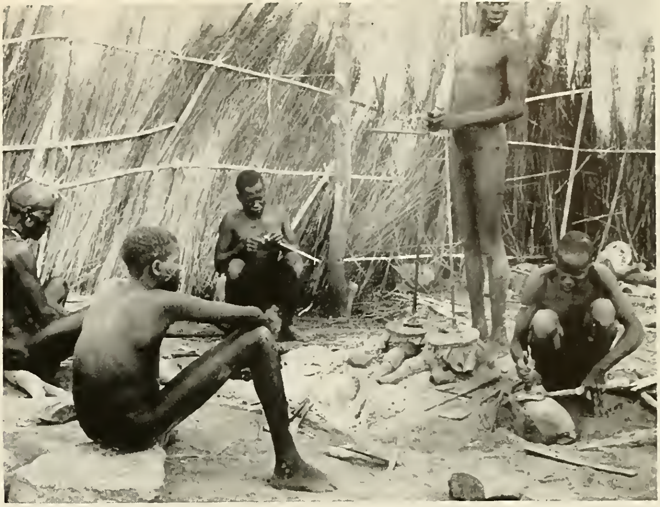
Often men hunt in small parties, but the hunts at large centers like Torit and Tirangole are weekly affairs with several hundred participants.

The *Lamonyremiyi*, or "Father of the Land," is a hereditary office which exerts real power in Latuko spiritual affairs. In Torit the office is now held by a woman, Abolo'ne. Before the hunt commences, she ensures good fortune by mixing charcoal and earth, spitting upon the mixture, and scattering it at the feet of the huntsmen while uttering an incantation. As Abolo'ne is too aged to go to the hunting field, her son, who will succeed her as "Father of the Land," completes the rite by lying on the hunting ground before the surrounding spearmen and exhorting them not to run from lion and buffalo but to attack them and protect each other. The hunters reply singly and in groups by running past him, brandishing spears in mock attack to assure him of their courage.

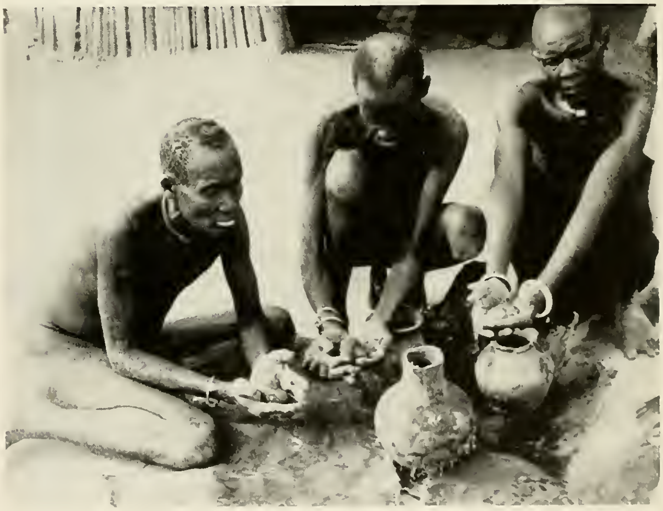
All spearmen then separate into two groups, each man carrying three or four spears. Some wear straw hats woven from local grasses, usually their only clothing; others carry diminutive stools on which to sit during any halt in the hunt. The stools are solid, having been carved from a single piece of wood. At the commencement of the hunt, two "horns," each consisting of a file of some 200 men, go out, one obliquely to the right, the other to the left. Discipline is excellent. Each "horn" spreads out to become a semicircle of three or four miles of evenly spaced men. When the leading men

▲ Women fishing. The fish were driven from far down the river anc

f the world. In 1863, Samuel and Flor-
nce Baker, the first white people to see
he Latukos, are said to have camped
nder this very tree



▲ Iron-working techniques have not changed here since the Bakers first observed them almost a century ago. A drawing almost identical with this photograph was published in their book

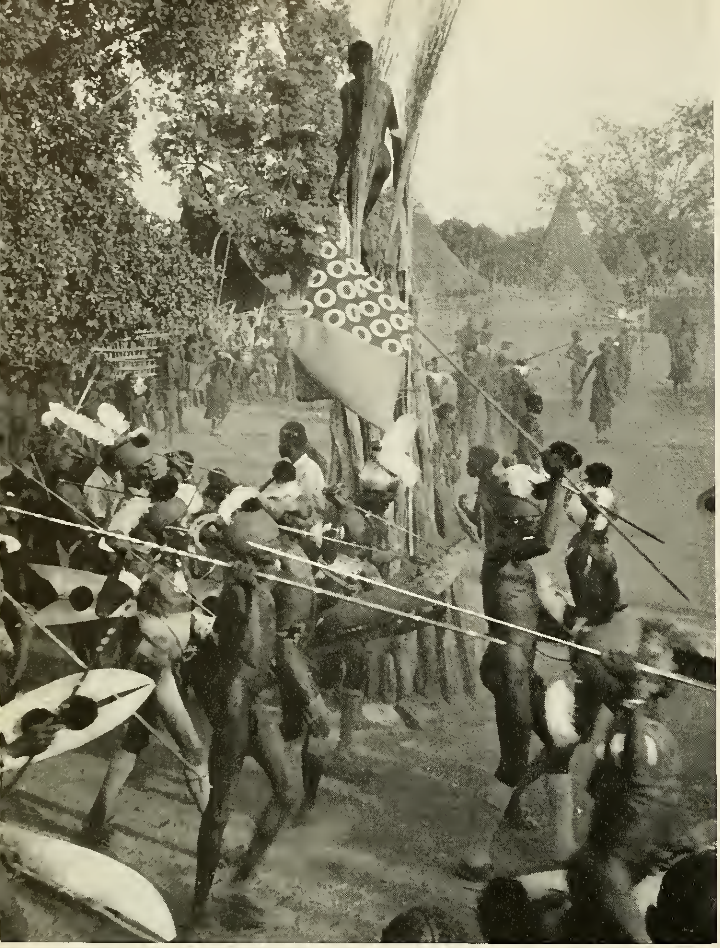


▲ Among the tribe's most sacred objects are the rain stones—vital properties in the annual rain-making ceremony. Few white people had ever witnessed this rite. The motion picture taken by this expedition and soon to be released is the first of its kind ever secured

:aught in woven nets—amid screams
reminiscent of a girls' cheering section

meet, all game within five to ten square miles has been encircled. The men then close slowly toward the center. All game trying to break out of the circle is their quarry; nothing is spared intentionally.

In the company of Mr. John Owen, the amiable and highly efficient District Commissioner of Torit, we witnessed three of these hunts. Most of the bags consisted of small stuff—oribi, kongoni, bushbuck, waterbuck, wart hog, hartebeest, lesser kudu, even guinea fowl—but we were in on the kill of one *na'swan,* a buffalo, which had enough spears bristling out of him to give the appearance of a pincushion. Other buffalo, however, broke through. When we noticed a



◄ THE DANCE celebrating the beginning of a new crop year: a stirring display of primitive pageantry

man failing to throw his spears at one of them, Owen remarked that the village women would sing of his cowardice for years. Several giraffes also broke through amid showers of spears, as did a rhino and calf.

Buffaloes are the most frequent big game to fall, and they usually even the score before succumbing. But leopards and lions are not infrequent, and occasionally an elephant is bagged, too. A small strip of the hide or hair from such big game is fastened to the ceremonial spear of the victorious hunter and is carried to dances. We saw many of them. It takes courage to work through shoulder-high grass, not knowing what it may conceal; but none of the hunters shirked such cover—and many were rewarded with game.

Fish are the women's quarry, and as in the hunting, hundreds of this gregarious tribe participate. In some villages the *Lamonyekhari*—"Father of the River"—sacrifices a black or red goat on the bank and throws its stomach contents into the water to propitiate crocodiles. At Torit, however, this rite is not observed.

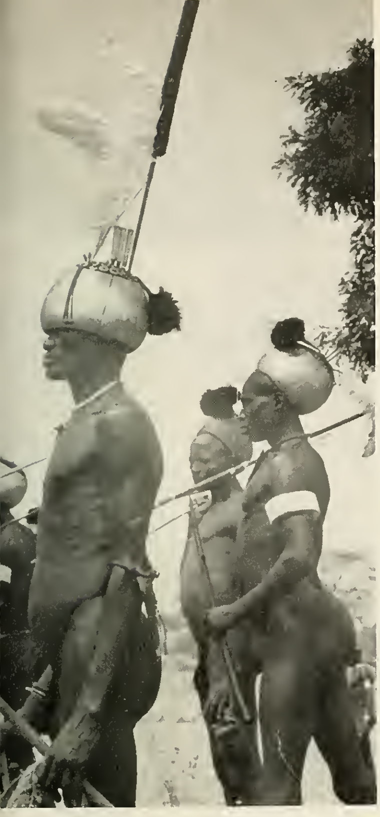
Girls and women of all ages gathered on the bank of the river. Each had a large leaf-fiber net bag of *sansevieria* (wild sisal) tied to her waist to put the fish into, while her arms wound about another net of the same fiber, which was for scooping up the fish. As the fishing commenced, 50 or so arranged themselves across the river to form a barrier. The remainder, starting a mile or more downstream, slowly waded en masse toward the barrier, driving the fish ahead. The older women squatted and searched the river bottom with their nets, while the young girls dove and pushed their nets along the bottom. The din sounded like the women's section of the grandstand at a ball park. Each screamed in excitement when a fish was caught in her net; others acknowledged in chorus. After an hour the two groups closed, laughing and shrieking, in a wild scramble for the trapped fish. Their haul was considerable, including many three-footers resembling catfish.

But the great magico-religious rite of Latuko life is the March rainmaking, which precedes the readying of land for millet planting. It entails hazards for the Rainmaker, too, as some Nilotic tribes have murdered their Rainmakers when prolonged droughts followed the rites. Mr. Owen persuaded a reluctant Lomiluk to reperform the rite for our cameras and sound recorders. As a reward I promised him my wrist watch, which he had admired.

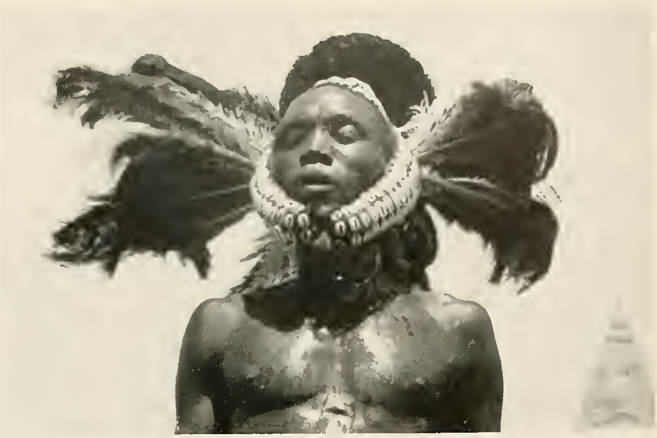
Hence one afternoon we were permitted to bring our apparatus into their holy of holies—the rain shrine enclosure. The rain shrine is the largest and tallest hut in Tirangole. In one corner of the ironwood palisade that encloses the village are five large clay pots each containing the bones of a departed Rainmaker. One has those of Moy, Baker's friend, another those of Lokidi, Lomiluk's father, who was killed in an intertribal battle in 1917.

While we were readying our cameras and microphones, one of our party rested the "clapstick," which we used to synchronize our sound and pictures, on one of these urns. Immediately ominous words and gestures issued from bystanders; the offending article was removed hastily!

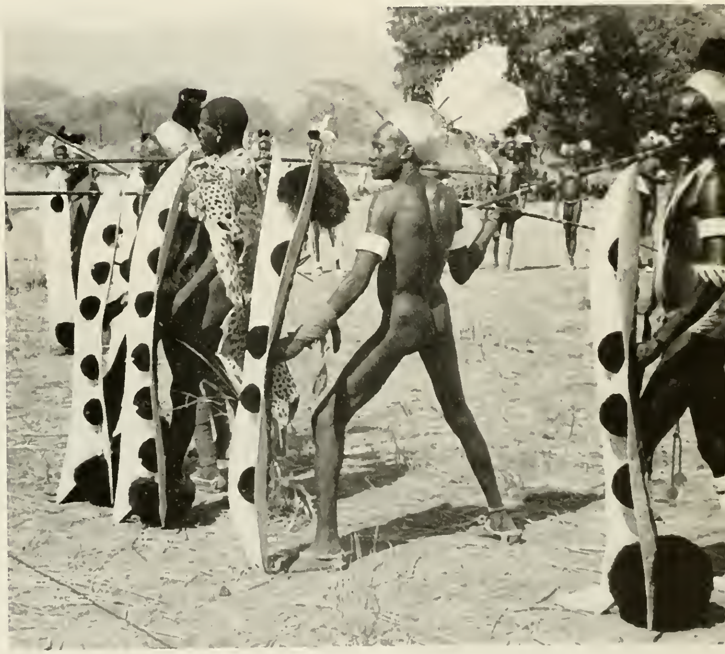
Kobu Lomiluk, who wore shorts belonging to the uniform provided



▲ THE HELMETS were of matted human hair covered with brass hammered from cartridge cases. Note the ostrich plumes and (on the nearest figure) the dark four-foot spike wound with the nuptial ruffs of 400 biship birds



▲ ANOTHER TYPE of Latuko headdress



▲ SPEARMEN in full ceremonial regalia, including buffalo-hide shields adorned with ostrich-feather pompons

him by the British, and three *Abalokos*—acolytes in native undress—arranged themselves before the rain shrine. Beside them stood a small black goat; it is necessary that the sacrificial goat be black. After some incantations, two *Abalokos* seized the goat and quickly strangled it. At this point Lomiluk's aunt came forth from the shrine with a half gourd of *mirissa*—millet beer—into which two *Abalokos* spat. Beer and earth were mixed with the contents of the goat's stomach, which were then carried into the rain shrine and rubbed on the holy rain stones, while the *Kobu* drank the holy beer. After five minutes, the *Kobu* and one *Abaloko* carried double handfuls of stomach contents to the urns, threw it upon them vigorously, rubbed the urns, and uttered a long incantation. The heavens having been thus propitiated, the ceremony was concluded.

Later the *Abalokos* brought the sacred rain stones out of the shrine for our inspection. As these stones symbolize solidified rain, they were handled with considerable reverence and were placed on a cowskin while we examined them. Each was a quartz stone slightly larger than a golf ball and rested in a musty clay pot.

During the ceremony, Lomiluk was a fine figure. Typical of his tribe, he was tall, erect, and finely proportioned. From his wide, muscled shoulders, his form tapered to well-developed thighs, with hips almost unnoticeable. Like all Latukos, his two lower incisors were missing; tribal custom requires them to be gouged out as soon as the permanent teeth have grown. His head was shaved, and typical decorative scars on his face and chest enhanced his austere bearing.

We were told that very few white men had witnessed this rite. Authoritative ethnological books admittedly describe it by hearsay. Certainly our sound and photographic records are firsts. Incidentally, the rite was extremely effective: it poured the following day!

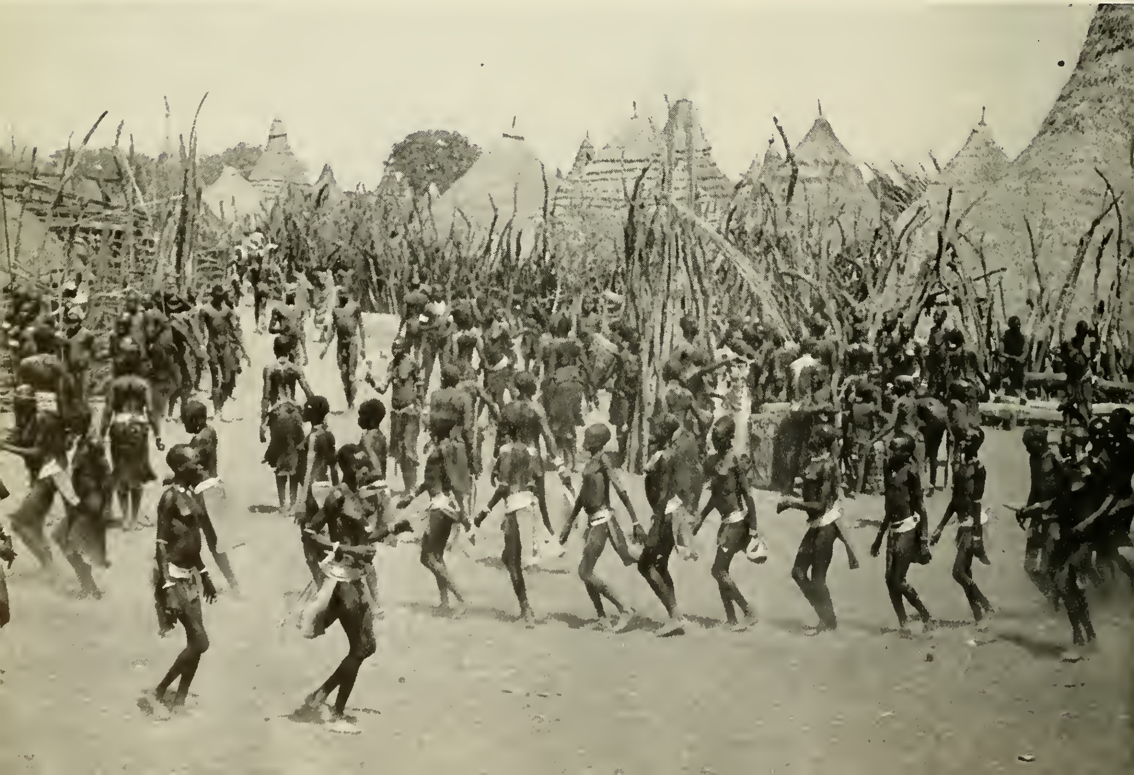
As the true rainmaking had taken place before our arrival, we were fortunately able to witness the *Na'lam*—a dance celebrating the beginning of a new crop year. It was a colorful, spectacular, dusty, and noisy affair. At noon of the first day of *Na'lam,* men gathered some two miles from the village for pre-dance festivities. The Rainmaker had slaughtered, or "sacrificed," three oxen by the simple expedient of having them bulldogged in cowboy fashion, then hitting their heads with an ax. If, as we were informed, this constituted a sacrifice, it was also eminently practical, for fires were built immediately and the meat was cut and roasted.

Warriors arrived at the scene of the "sacrifice" in parties averaging 20 or so, yelling like Indians and brandishing spears. Each group dogtrotted around the ground, stopping occasionally with spears poised in a mock attack on an imaginary enemy, and then retired to the shade of trees to feast and watch the performances of succeeding parties. Costumes varied. Some wore red helmets of matted human hair, from which ostrich plumes protruded; others had similar hair helmets covered with brass made from cartridge cases and topped by four-foot spikes, around which were beautifully wound the nuptial ruffs of male Bishop weaverbirds. Approximately 400 red-and-black ruffs adorned each spike. Several groups carried white buffalo-hide shields, each dotted with five large black ostrich-feather pompons. Divergent tastes expressed themselves in skin embellishments. Some were smeared gray with dung ash; some torsos were covered with red ochre designs; a few faces were streaked blue. Some heads were clean-shaven, others were shaved into patterns—coxcomb, topknots, or polka dots, looking as though sticky black peppercorns had been sprinkled on them. All wore beads galore and ivory armlets—cross sections of the bases of elephant tusks.

From the village streamed a steady procession of women balancing on their heads gourds filled with *mirissa* for their men's libation. *Mirissa* is the fermentation product of millet; it is pink and frothy.

➤ **Drums** of different pitch boomed a greeting as the villagers approached the ceremonial ground

⮟ **Dance of the Virgins.** The participating maidens wore iron-mail aprons made of small chains, with cloth in the rear



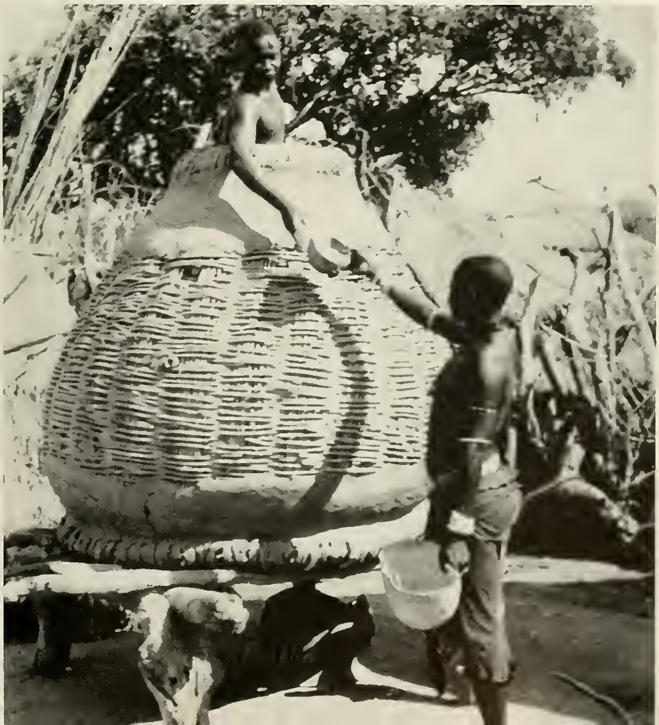
About four o'clock in the afternoon both men and women danced en masse to Tirangole. Drums, arranged alongside a tall pile of ebony and ironwood in the center of the village commons, boomed a greeting. Immediately after the group arrived, the dance began. There was little semblance of order. The dust rose in heavy clouds and, as the tempo of the dance increased, covered the entire village with a suffocating fog. Dancers could scarcely see one another, but their exuberance remained undampened. Occasionally one woman would throw handfuls of millet into the melee; undoubtedly this had symbolic meaning. At times the Rainmaker himself drummed, two men holding a rattan awning over him to ward off the sun's rays.

At sundown we departed for our camp. Tirangole could be marked from afar by what appeared to be a rising column of smoke from a gigantic fire. It was dust! The dance continued all that night and throughout the following day; dancing alternated with resting and *mirissa*. Certainly the success of their crop must have been assured!

But this sketchy account is only an introduction to some elements of Latuko life. Here is a people for whom nature supplies all material wants, while magic ministers to their spirits. They are as content as it is human to be—even as our European ancestors were a hundred centuries ago.

How long will the primeval last in Tirangole? How long will it remain unchanged? The British intend to withdraw from the Sudan in the comparatively near future. If this eventuates and the Sudanese attempt to rule themselves—or, as seems more likely, if they are governed by the Egyptians—changes will come slowly if at all. Even if the British remain, change will come about much more slowly than in more accessible parts of Africa. It takes two weeks to ship cargo up the Nile from Khartoum to Juba, then a day's journey by road to Tirangole. Six months' rain and six months' drought are not conducive to profitable agriculture, and the rolling terrain makes irrigation impossible. The climate is inhospitable; virulent diseases are prevalent. It was not until the end of World War II and the advent of ultramodern medicine that British officials were permitted to bring their families into Equatoria. So perhaps our Latukos are safe, for a time at least, from the stress and atomic fever of "civilization." If so, may their Rainmakers be attended by the same success as *Kobu* Lomiluk was in March, 1950.

▼ THE GREAT CEREMONY is to ensure a bountiful crop of millet, which is stored in huge containers like this



BOOGUM—

Desert Contortionist

A plant individualist of Lower California that can't be accused of making the landscape look ordinary

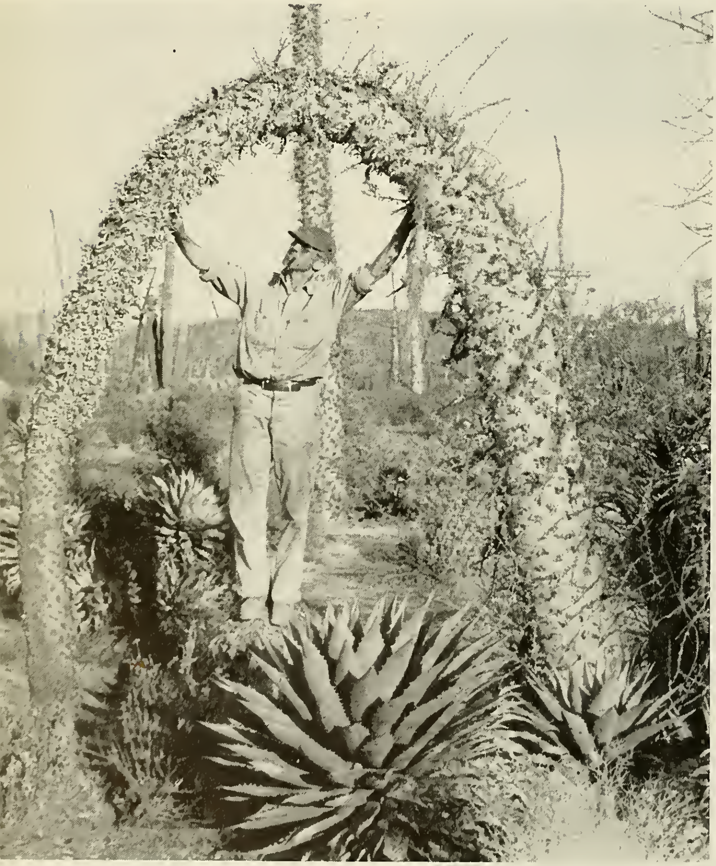
By Lewis Wayne Walker

Photos by the author

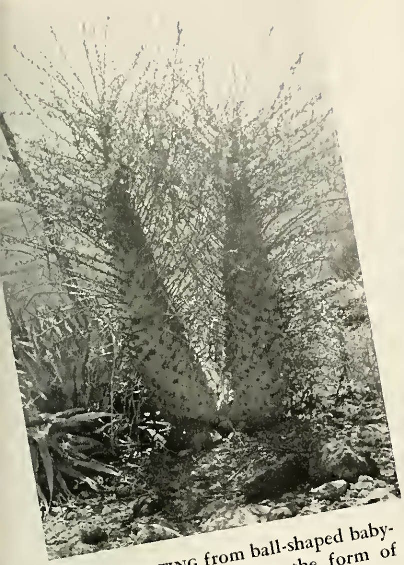
THE road that penetrates the peninsula of Baja California is bumpy, and on reaching Hamilton Ranch, the last outpost for tourists, it resembles two cow trails that sometimes run a parallel course. Ten miles an hour becomes an exhilerating speed, a pleasant respite from the low-gear grindings in the deep arroyos. To the right, rocky points jut out into the Pacific; to the left, rolling hills rise to a plateau that saddles the central part of this seldom-visited area. Two hundred and fifty miles south of the border the trail gradually swings to the east, and hours later, with the Pacific far to the rear, it enters the weird forests of Boogum or Cirios—a region where the outlandish becomes commonplace and where strange silhouettes and botanical contortionists encircle the dusty traveler.

Many of these cirios rise straight into the air and end with a burst of small blooms on the crown fully 50 feet above. These tall, rigid spikes are, no doubt, the normals, but in every group that adheres to the straight and narrow there are a few that seem to have lost all sense of direction, and instead of reaching for the sky they throw crazy loops supinely along the desert sands. Others start growth in a conservative way and then gradually arch in a downward circle, finally burying their heads in the ground and taking root at both ends.

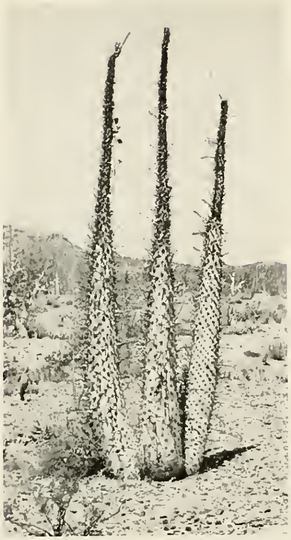
As saplings, cirios look like balls almost as wide as they are high, protected from grazing animals with numerous rigidly-spined twigs protruding from the grayish bark. These twigs show a distant relationship to the more familiar desert ocotilla, but from there on, close similarity to any other plant seems to vanish. As the young plant grows,



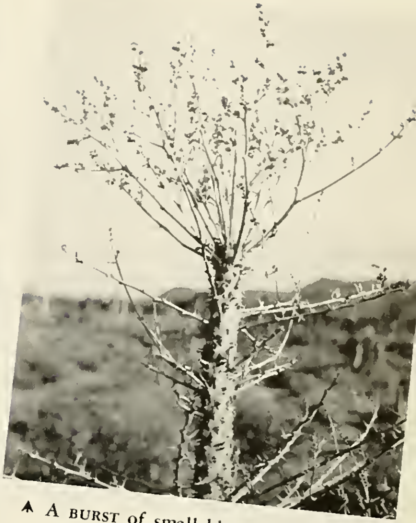
◄ Having buried its head in the sand, this boogum has outdone the fabled ostrich and literally rooted itself at both ends



▲ GRADUATING from ball-shaped babyhood, the boogum takes the form of an inverted ice cream cone for a time

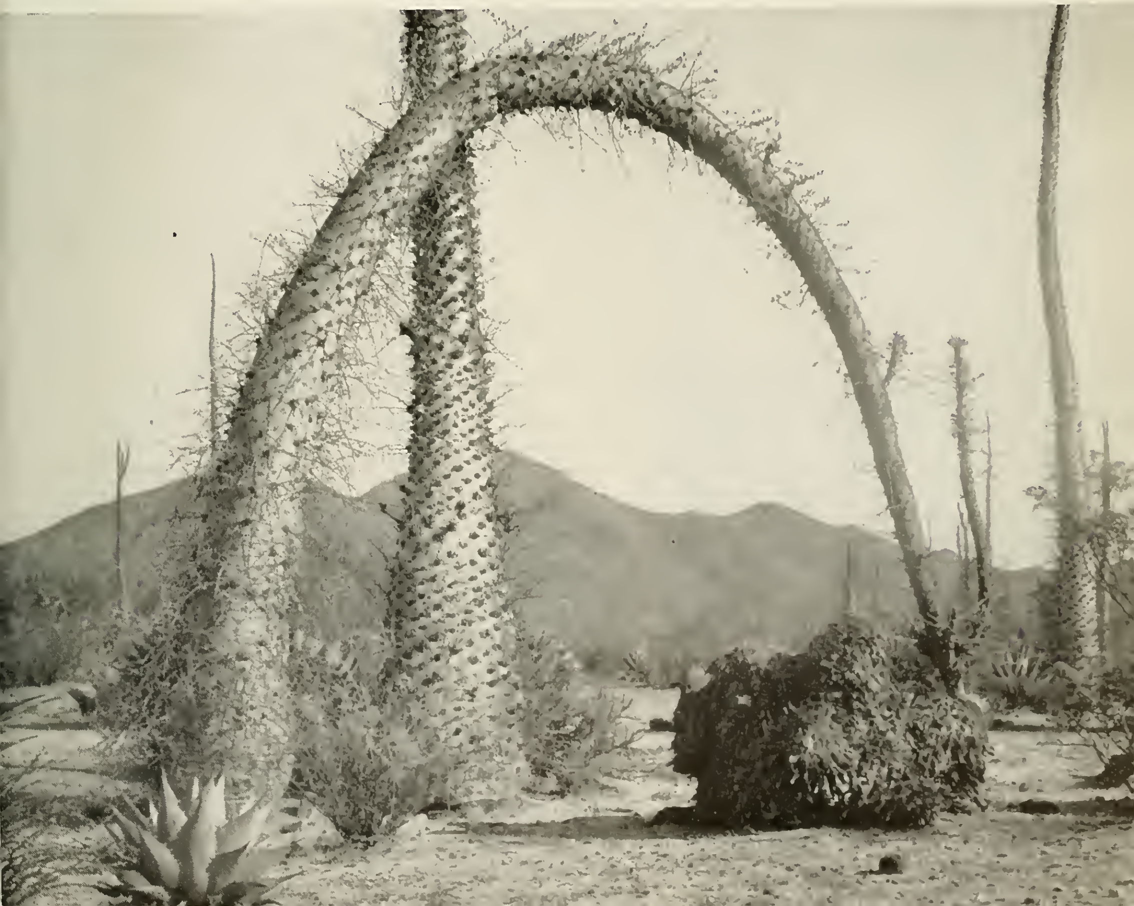


▲ ABOUT one-fourth grown: a homely trio in a barren homeland



▲ A BURST of small blooms enlivens the top of the boogum spire

▼ SOME grow this-a-way, and some grow that-a-way



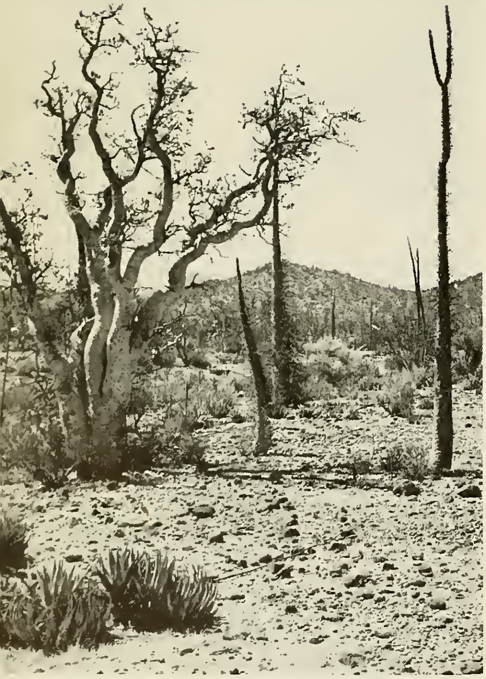
rapidly in wet seasons but practically not at all in dry, the armored ball gradually starts to elongate and tapers to a point at the top. During this vertical development, it also spreads at the base until the whole plant, on reaching a yard in height, resembles an upside-down ice cream cone.

Just below the surface of the ground, horizontal roots radiate in all directions; and when the cirios attain their 50-foot height, the root pattern forms an almost solid blanket beneath the soil. Sometimes after the rare desert rains have brought about the growth of grasses on the usually arid sands, the effect of the underground root system and its drainage of life-giving elements can be plainly seen. The ground for many yards on all sides of these scattered plants is practically bare by comparison with other areas where the cirios are not present.

Just as the cirio is strange in life, it is also strange in skeleton form. In death, the long straight shafts turn a yellow-white; and when the bark and inside pulp has rotted away, you see only a circular wooden wall pockmarked with thousands of small holes. Some of the quarry workers at the onyx mine at El Marmol have utilized these skeletons by sawing them into cross sections and hanging them as rustic garden baskets. If they were more plentiful and transportation were not such a prohibitive problem, they would be in popular demand here in the States.

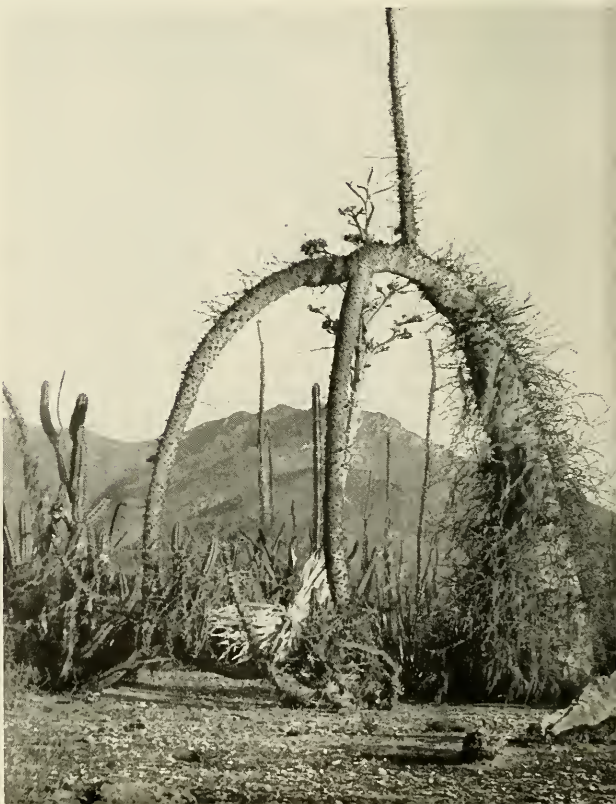
Occasionally, the living trees develop some imperfection that allows the Italian honeybees, which have spread into this area, to invade the hollow center. Some residents of the town of Punta Prieta in the heart of the cirio country make their entire livelihood by robbing boogum hives, and they report that a big tree will frequently contain over one hundred pounds of honey.

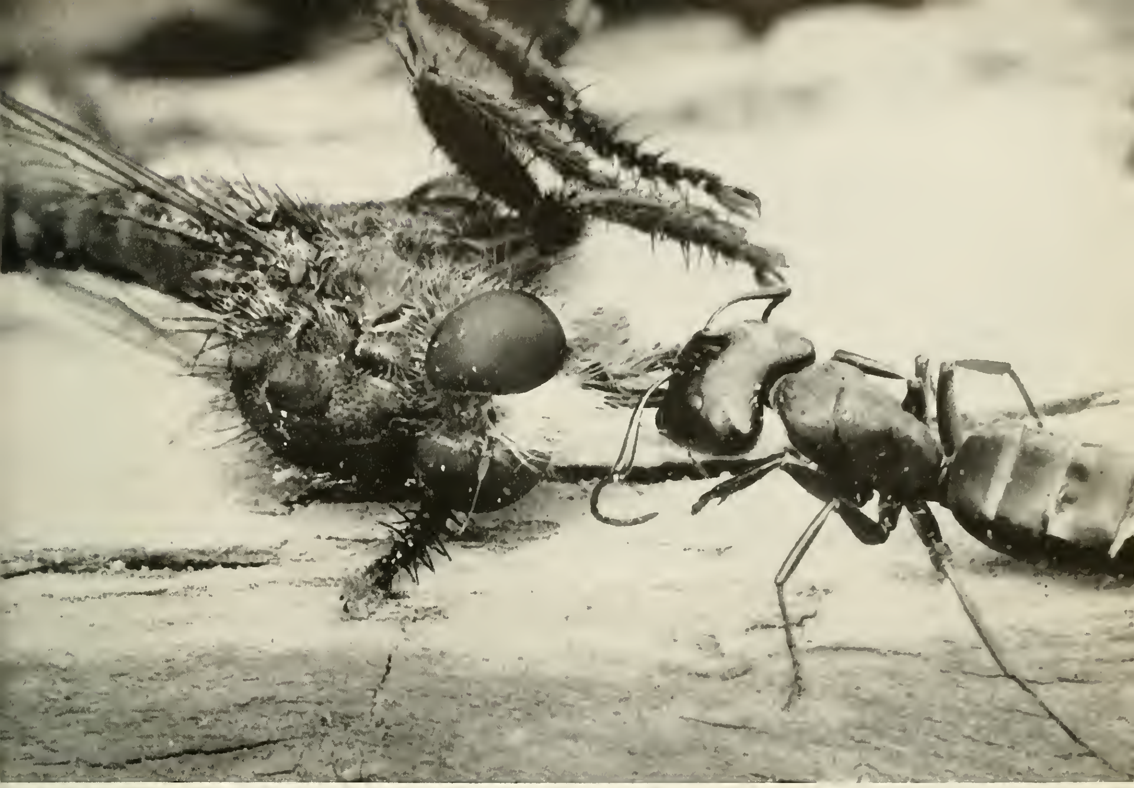
Throughout most of the belt where the plants exist, which is 300 miles from north to south, the exotic contortionists might not be called beautiful. But in a few valleys, groves of them have become infested with a picturesque lichen, similar in appearance to the Spanish moss of the southern swamplands. In these localized regions, the stern rigidity of the plants is softened with wind-blown tassels of browns, grays, and greens. Although these blighted trees are no doubt doomed, they become increasingly attractive as they wage their losing battle for survival. Scattered about the ground, however, in these parasitized groves there are countless ball-shaped young. A score of wet seasons or several score of dry will bring them to maturity, and by that time the beautiful but disastrous lichens may have moved on to clear some other area.



▲ An elephant tree and a boogum

▼ After planting two arms, this boogum continued to strive for height





▲ A MAJOR WORKER of *Camponotus pennsylvanicus* (a posed specimen) about to tear down a captured robber fly before carrying the pieces to its nest

Carpenter Ants

The domestic affairs of these master "wood-workers" indicate that their reputation for destruction may be exaggerated. But if you find them a nuisance, there are effective means of control

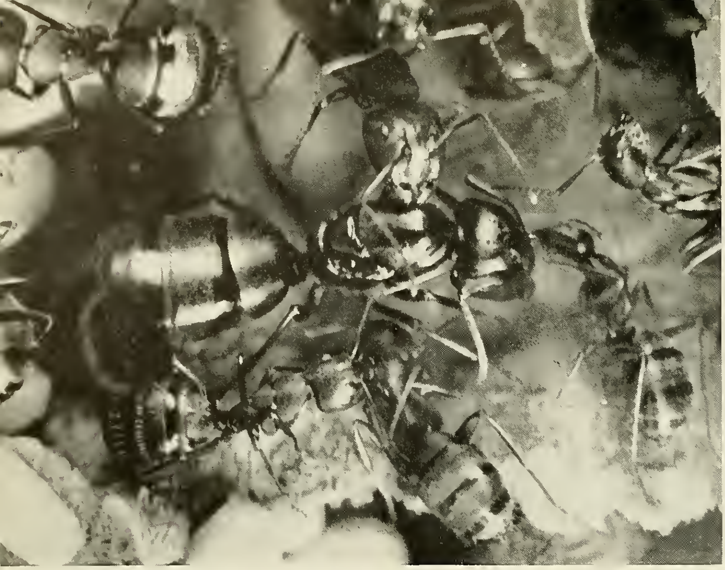
By T. C. SCHNEIRLA

Curator, Department of Animal Behavior, American Museum of Natural History

Photographs by LYNWOOD M. CHACE

THESE ants of the genus *Camponotus* are popularly known as "Carpentėr Ants" because they work in wood. It might be more fitting to call them "wood-carving ants," because they do not actually build of wood but gnaw out the soft or partly decayed interior of logs or stumps. When this wood-carving process is carried out extensively by a colony living in the forest or in a human habitation, the interior wood is virtually riddled. In the final stages, the chambers and galleries of the ant nest are separated only by thin partitions or narrow pillars.

You may have had opportunity to examine the extensive galleries of a colony of these ants in a felled tree, or you may have heard a neighbor express his anxiety at having carpenter ants in his house. It is easy to gain the impression that these ants are deadly enemies of trees in general and of people inhabiting wooden houses. Before attempting to assure you that the problem is not always as desperate as it may appear, I suggest that you acquaint yourself with some of the interesting habits of these creatures. A simple and effective artificial nest can be constructed by putting some of the ants and some wood from their home nest into a quart bottle. The bottle is then covered with a piece of cloth for the next few days, or long enough for the part-colony to become established. A rubber or glass tube may be used to connect the bottle with a smaller bottle or a glass-topped box that serves as a



▲ A MATURE QUEEN of the same species, divested of wings after mating, in the company of workers. One of the workers is licking the queen's thorax. The workers are strongly attracted to the queen, especially because of her fragrant odor, and they spend a large part of their nest time licking and polishing her body

food place. In an artificial nest of this sort, the ants will thrive on a diet in which sugar-water, pieces of insect body or cooked meat, and boiled egg are given successively.

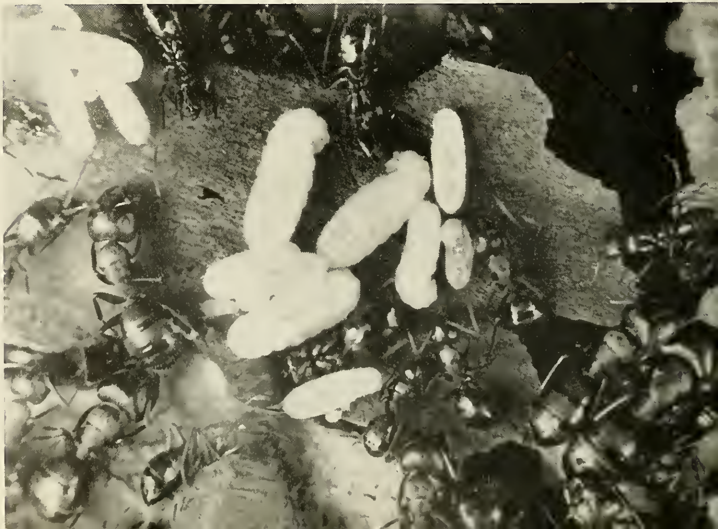
This setup may be used to carry out many interesting and instructive tests on the behavior of the ants. For example, a path may be complicated by a simple maze apparatus, and the learning of specially marked workers may be tested. Or orientation to visual stimuli may be investigated by shifting a light to the opposite side of the path after the workers have established their route. In this and similar tests, the disruptive effects of changes in the route or its landmarks should give useful clues as to how the habit of traversing the maze was established.

The ants are blind to red light, so it is possible to observe the colony with its brood and queen in one of these artificial nests without disturbing their activities. Thus the domestic affairs of the Camponotus colony can be worked out through careful observations. The manner in which workers feed one another, the queen, and the larvae by the regurgitation of the liquid contents of their crop merits detailed watching. As W. M. Wheeler demonstrated in his important book, *The Social Insects* (Harcourt, Brace: 1928), these exchanges among individuals, together with similar acts such as the licking of larvae and the queen's body surface by workers, and of worker by worker, provide the basis for the essential unity of the colony.

Another kind of interchange occurs when the colony is roughly disturbed, as by a sharp rapping on the artificial nest or on the shell of the log housing a colony in the open. Then the workers, and especially the largest (or major) workers, rush excitedly about, spreading the excitement and alerting the colony not only by the actual physical collision of antennae and bodies but by another and indirect means. This involves the rapping of the abdomen (and sometimes the head) against the wooden substratum, a procedure that sets up vibrations which reach other workers through the wood, exciting them at some distance. In an artificial nest provided with a floor of hard cardboard, the abdomen rapping of agitated workers gives rise to vibrations audible to the human ear as a rapid patter of faint drumbeats.

In many subgenera, species, and subspecies, ants of this genus are found almost throughout the temperate and tropical zones around the world. Species such as our ubi-

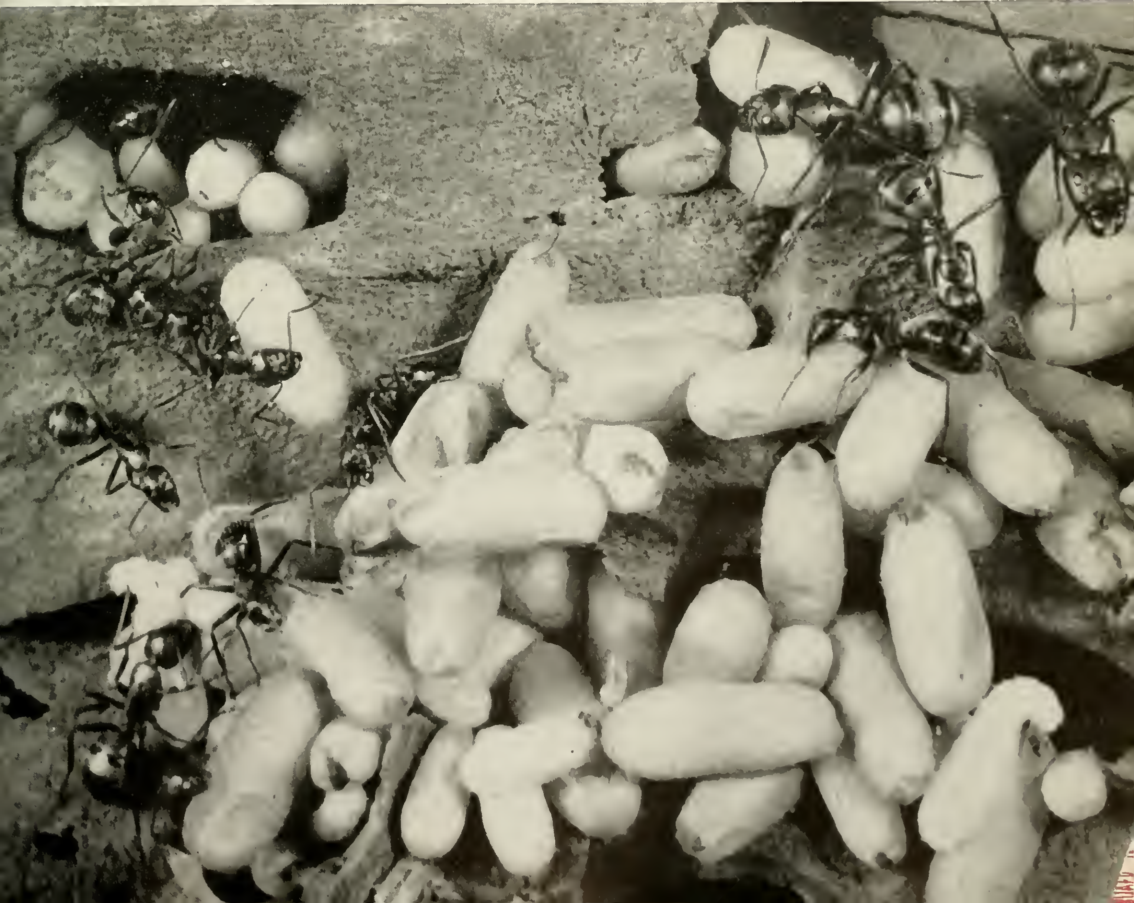
▼ WORKERS with the whitish grubs, or larvae. The worker in the upper center has its mouth part against the mouth of a larva, regurgitating the liquid content of its "social stomach." The smaller workers engage more frequently in this than the larger ones. Big larvae produce soldiers, smaller ones workers of the intermediate and minor castes. But here some of the size difference is due to difference in age. *(C. pennsylvanicus)*



quitons *C. pennsylvannicus* and its reddish subspecies *C. pennsylvannicus ferrugineus* of the north-temperate regions are characteristically found in shady woodlands, where they generally establish their nests in stumps and fallen trees. The excavations of many species like *C. pennsylvannicus* are made mainly in wood; the nests of others like the subspecies *C. pennsylvannicus ferrugineus* are tunneled extensively in the soil and only secondarily in the wood above; while the nests of other species like the yellow *C. castaneus* of our northern states are burrowed exclusively in the ground. Under propitious conditions, standing trees are frequently entered by some of the species; and among these species, *C. pennsylvannicus* often makes its nests in the wood of human dwellings. Perhaps the most specialized and curious of all Camponotus nests are those of species in the subgenus *Colobopsis,* mainly confined to the southern states. Colobopsis nests are found in hollow twigs or in galls; however, they are not very easily found, for their small entrances are plugged against come-what-may by the curiously flattened heads of the major workers, inserted like corks into the openings. The living door remains in place until a few short taps from the antennae of a returning worker on the outside, or a brush from an ant ready for exit on the inside, causes it to open and stand ajar briefly.

The colonies of the black species *C. pennsylvannicus* and its subspecies *C. ferrugineus* of the American temperate zone may grow to be fairly large. There may be as many as a few thousand workers, a single reproductive female (the queen), a brood of varying make-up, according to the season, and at certain times of year a considerable number of young winged males and queens. As with many other species of Camponotus, the workers (or neuter females) are polymorphic; that is, they range in size and type from the large and robust workers-major to the smallest, the workers-minor. The queen is readily distinguished from the workers by her great size, her large head and bulging thorax, and by the high polish she generally acquires from the almost incessant licking and stroking of her body by workers.

▼ Carpenter Ant workers busily transporting their brood away from a scene of recent disturbance, a human invasion. Ordinarily, as the outer shell of their nest log warms up during the morning, the workers transport their brood from inner chambers to sections near the bark. *(C. pennsylvannicus)*



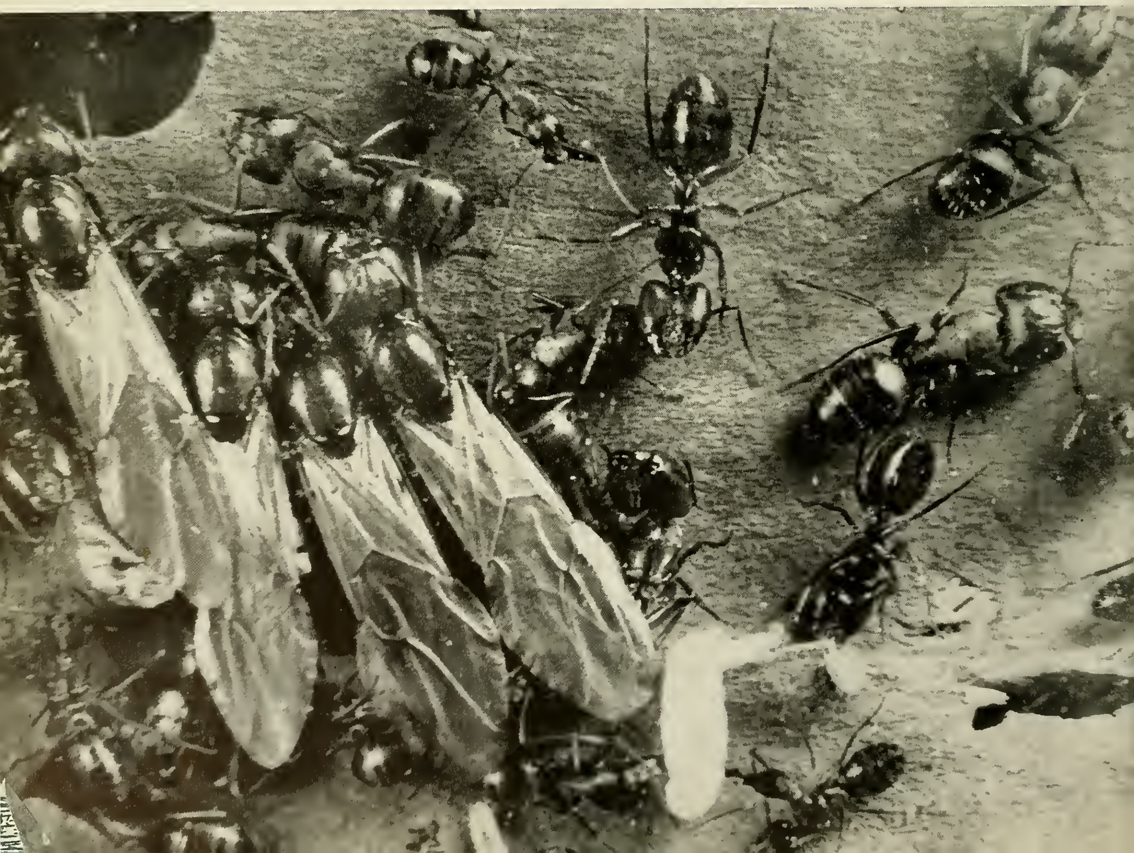
Colonies that have weathered the hazards of their first two or three years are usually able to produce reproductive individuals—the large winged males and females. The late-summer brood of males and females, after emerging from their large cocoons, usually remain in their parent nests through the winter, huddled in clusters with the hibernating workers within the inner recesses of their catacomb-like shelter. They make their exodus early in the following warm season, in late spring or early summer as a rule. If the occupants of a house have been unaware of a flourishing Camponotus colony within the foundation beams, the discovery is likely to come on some warm day in late spring, when from some chink in the molding a whole host of males and numerous females may come out into the room.

In the open, the winged males and females spill out of their home nests on the warm and bright days from May into July and soon take to the air in a mating flight. This results in the fertilization of many of the females. In contrast to the large-eyed but tiny-headed males, which cannot survive long as solitary individuals after the flight, many of the inseminated queens return to some woody surface or to the earth and are able to establish themselves. Fascinating and unsolved problems are presented both by their behavior and their physiology, which seem to change markedly after fertilization has taken place.

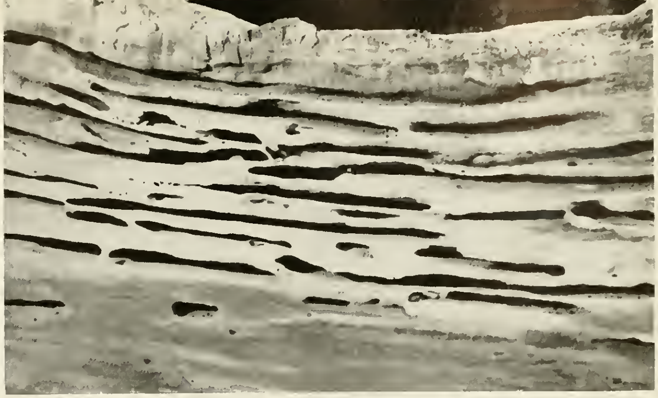
When a fertilized queen descends from her flight, she drops or bites off her wings, then soon becomes photo-negative. That is to say, she is markedly light-shy, whereas before fertilization she was light-positive, as indicated by upward spiraling toward light in the mating flight. As a result of this change, when the newly fertilized queen reaches a sheltered dark place, she settles down. If accidentally exposed to light, she again promptly disappears from view. In the northern states, if you pull strips of bark from logs and stumps in the late spring, you are likely to expose one or more newly established Camponotus queens. Each is in a little cell ringed around with a wall of wood fibers set up by the queen herself. Or she may find her way into the deserted burrow of a tunneling wood beetle in which she comes to rest at some turning. She may perish through seasonal vissicitudes or through the invasion of her cell by ants or other predatory insects. Otherwise, however, the young queen can survive by living on her own tissues and can found a colony through her own resources.

Her now degenerating wing mus-

▼ Workers, larvae, and winged females, recently installed in a glass-topped artificial nest. ***(C. pennsylvannicus)***



⮝ A WORKER about to lap up the sweetish fluid secreted by one of the aphids on this stem. Note her antennae, the slow oscillation of which has been caught by the camera. *(C. pennsylvannicus)*



⮝ CHAMBERS AND GALLERIES of a Carpenter Ant colony carved out in the soft interior of an old log. The chambers are long and wide and are connected by narrow galleries. Notice how the excavations run mainly with the grain of the wood. The excavated chambers and galleries occupied by a flourishing *Camponotus* colony may extend as far as a few feet along the log

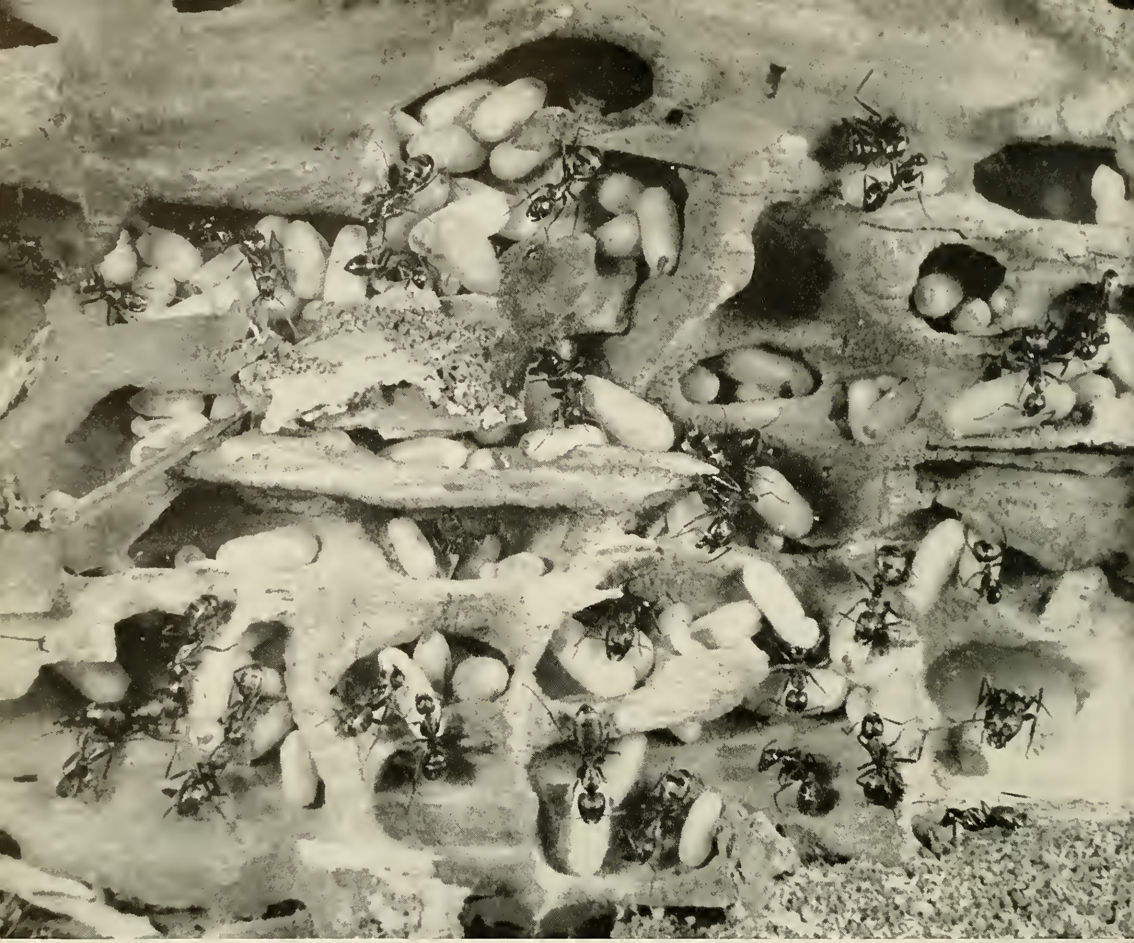
cles and the fat bodies with which she is abundantly equipped provide nourishment for her and her first brood. For, unlike the colony-founding queen of some Australian ants of primitive ponerine species, which leave their cells and forage about, thereby procuring food for themselves and for their first brood, the Camponotus queens remain sequestered and have no food except what is available from their own bodies. On this special "reducing diet," the queen soon begins to lay eggs, and with this substance she can feed the larvae which presently appear.

That the first brood is not lavishly fed by the queen is evident from the very small stature of the few workers that appear in the first lot. They are all of the worker-minor caste. However, these diminutive workers may succeed in consolidating the young colony by slowly extending the nest and by foraging in the environs, bringing in food that is used to replenish the queen's reserves and feed the additional brood. If the first pygmy workers do not carry out such work effectively, the colony is likely to perish. If they work well, the population grows and the nest is extended into wood and earth. As soon as the first workers have appeared and are busy in the nest, the queen turns to producing eggs as her exclusive task. Thereafter she labors no more except in this important capacity as egg-making machine.

Once a colony has gained its first good foothold, the larvae presently are sufficiently well fed and develop into workers of the larger type, the intermediates or majors. With a good food supply, a temperature near 75 degrees F., and not too much or too little moisture in the air, the workers of *C. pennsylvannicus* require a little more than two months for their complete development from newly laid eggs to the callow (or newly emerged adult) stage. This period is divided roughly as follows: 23 days from the laying of the egg to its hatching into a larva, 21 days for the growth and maturation of the grublike larva, and 21 days for the development of the mature larva within its cocoon into a prepupa and then into the adult-like pupa. Sunny and somewhat humid weather generally hastens development; cool, unusually variable, or very dry weather is likely to retard development. Although the workers require the larger part of a summer for their development, they are adults when the pupal stage is finished and grow no more after they emerge from their cocoons. In this they are very unlike the termites.

The hardiness of established colonies of carpenter ants is due not only to the excellent insulating properties of their dwellings but also to the fact that most of them can subsist on a variety of food. The larder has as its main item large supplies of nectar obtained regularly through spring and summer from honeydew produced by aphids and other "ant cows," which the Camponotus workers visit on surrounding plants. The ants also gather considerable quantities of insect flesh. They work both as scavengers, collecting dead insect bodies in the neighborhood of their nest, and as predators, bringing in freshly killed insect victims. The foragers are generally able to bring their live captives under control by biting them with their powerful mandibles and also by squirting especially resistant subjects with formic acid.

In our diurnal species such as *C. pennsylvannicus*, which do most of their foraging in the daytime, an intermittent traffic of workers is usually to be observed making re-



▲ **Adult workers** with brood, mainly pupae in cocoons. In this stage, the young worker matures from the larva into the adult form. When newly emerged, it is gray because of incomplete pigmentation. Within a few days it shows the jet black of regular adult *pennsylvannicus* workers

peated excursions to near-by plants where aphids are feeding. Each time a worker mounts a plant, she begins to stroke the aphids with slowly oscillating antennae, thereby stimulating the emission of their sticky, sweetish secretion. After lapping up enough of the nectar to fill her crop, thereby stretching out the walls of the gaster, or abdomen, very noticeably, the worker hurries off to the nest with her heavy afterpart waggling in a manner that the observer is likely to find quite amusing. At the home site, the load is regurgitated to other workers, with a frenzy of rapid strokes of antennae as the food transfer begins, then with slow regular antennal movements as the food transfer gets under way. Emptied of her load, the aphid-visitor rushes off with crop contracted and abdomen small to obtain a refill at the source of supply. The trips continue in this way for many hours, and one worker may make dozens or scores of food-gathering trips in a single day. It is interesting to note that the nectar-gatherer may make most or all of her visits on a single day to the same part of the same aphid colony on a particular plant. At the same time, other foragers are specialized in capturing and lugging either dead insect hulks or freshly killed prey.

The destructiveness of carpenter ants to wood is not always easily appraised, and there are divided opinions on the question, even among specialists. It is argued on the one hand that while these ants and their work frequently may become a considerable nuisance, especially around dwellings, the actual extent of the damage they do may not be nearly so great as imagined. In most cases, it is contended, the carpenter ants make their nests in wood that is already softened by decay or penetrated by the burrows of wood-boring beetles. The Camponotus technique of wood-riddling may actually no more than hasten the inevitable decay of presoftened wood. The degeneration of doomed trees, logs, and stumps is of course an ordinary and a biologically essential factor in the life processes of any forest, and Camponotus colonies incidentally make their contribution to these processes.

There are others, with many forestry specialists and entomologists among them, who insist that Camponotus colonies must be considered destructive in the last analysis. It is pointed out that in less settled areas the more common *Camponotus pennsylvannicus* generally nests in standing timber and not only in partially rotted trees but also in sound ones. This species also has been found tunneling in the sound dry wood of telephone poles, cabin posts, and the rafters of buildings, which may have been invaded in the first place through cracks as well as through damaged or decayed places. This species, therefore, is put down as a frequent offender against man's interest in timber and in the wood that he uses. It appears also that relatives, such as members of the American *Camponotus herculeanus*, which live in the coniferous forests of the northern states and Canada, frequently enter standing trees and hasten their destruction. The various Camponotus species are not equally blameworthy from this standpoint; for example, *C. ferrugineus* is found almost always in predecayed wood, such as that of logs beneath which the colonies have excavated their nests in the soil.

With the advent of European man and his wooden structures in America, Camponotus has had the opportunity to invade human habitations in much the same way as wood is entered in the forest. *C. pennsylvannicus*, in particular, is frequently found in houses near woodlands. Where cracks, crevices, and faulty joints exist in beams and other exposed wood parts, the entrance of these ants is facilitated, and nests may be established if the interior wood is soft enough to be worked. Colonies may also establish themselves in piled lumber sometimes moving over from fireplace logs heaped near by.

Householders can greatly reduce their troubles with carpenter ants by the appropriate use of paint and tar on the rafters and beams of houses and other wooden structures near wooded areas and by storing spare lumber with discretion. It is doubtful that Camponotus often causes serious damage to really sound wood. The unpopularity of these ants in many quarters seems rather to result more from their nuisance value than from any actually identified destruction. However, if you prefer, as most householders do, to study Camponotus at a safe distance from your home, steps may be taken to remove them. Dr. C. H. Curran recommends spraying the entrances to the nest with a one-half per cent water emulsion of D.D.T. or Chlordane. The fluid should be soaked thoroughly into the wood. In extreme cases, holes can be bored in beams and rafters through which it can be forced into the interior of the nest. Tests carried out at Bear Mountain showed that a water-base insecticide is satisfactory, whereas an oil base is not, because it does not soak well into wood. If thorough, such measures should be effective in destroying a colony.

An interesting relationship between carpenter ants and man has been discovered recently in Florida. In the spring, before the winged Camponotus males and females carry out their mating flights, the orange growers are engaged in "dusting" the trees in their groves. Not uncommonly the sacks are strewn on the ground near the trees or at the edges of the grove. Although such a result is probably far from the minds of the orange growers, the empty sacks afford good cover for the queens of the common reddish *Camponotus floridanus*[*] and for their young colonies as they develop. The relationship must be partly beneficial to the orange groves by ensuring a supply of Camponotus workers to reduce the population of injurious insects in the grove. On the other hand, it may prove more detrimental than helpful, depending upon the extent to which the ants remove beneficial as well as injurious insects or stimulate plant parasites. Investigation seems in order, to show whether for the sake of the orange crop, the growers should pick up their sacks.

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[*] *C. (Myrmothrix) abdominalis floridanus* (Buckley).

➤ A GROUP of Queen Carpenter Ants with wings. They will soon swarm and mate and fly to a new location, where the Queen will begin a new colony. The Queen loses or cuts off her wings after reaching the new location

▲ THE GIANT TORTOISE succumbs quickly to civilization. It is hoped that secrecy will protect the large groups recently discovered on Indefatigable Island until protective laws can be passed and enforced.

Strange Reptiles OF THE GALÁPAGOS

By ROLF BLOMBERG

All photographs by the author

These "Enchanted Islands" support some of the oldest animals alive on earth and have been of special interest to biologists since Darwin's memorable visit

WHICH are the oldest living animals in the world? In all likelihood, certain tortoises are—perhaps the ones living on the Galápagos Islands. It is believed that the largest specimens have reached ages of 200 to 250 years. In other words, these old fellows, whose acquaintance I recently made in the Galápagos, could have been youngsters at the time of George Washington's boyhood.

And how big are the biggest? It is hard to weigh a tortoise, and I certainly was not equipped to try. But a Galápagos tortoise that was brought to California in 1899 may give some idea. It weighed only 29 pounds at the time, but when it died only 15 years later, it weighed 415 pounds.

Legend has it that the first human beings to visit the Galápagos Islands and see these monsters were the Inca Emperor Tupac-Yupanqui and his followers, long before the Spanish Conquest. But the first historical report dates from 1535. It was in that year that Tomás de Berlanga, Bishop of Panama, set sail for Peru. After a week of favorable winds, he was becalmed, and for eight days he drifted helplessly in the Pacific, driven off his course by strong currents. But on the eighth day he unexpectedly sighted some islands on the horizon and by mere chance discovered the Galápagos Islands.

This isolated group of Pacific islands is situated on the equator, about 500 miles west of the South American continent. The islands belong to the Republic of Ecuador, and their official name is the "Archipiélago de Colón" (the Columbus Archipelago). One often hears them called the "Enchanted Islands," and William Beebe gave them the striking name of "World's End." The islands spread over an area of nearly 3000 square miles, but only 13 or 14 are large enough to be marked on small-scale maps. The largest island, named Albemarle or Isabela (every island has two, often three names), is about 95 miles long and 15 miles wide. Some of the largest islands, which at the same time are the highest, are suitable for agriculture and settlement, but most of them are too arid.

The characteristic appearance of the dry coastal belt is given it by the cacti and scraggy brush that cover it. In the uplands, above 600 feet, the vegetation changes and becomes more fertile, and here forests and grassy plains flourish. In 1832, the islands were officially annexed by Ecuador and the first settlement was founded by the Louisiana-born general José Villamil. But the population of the islands has never increased to a large extent. The present population is now less than 2000 inhabitants and is formed mainly of Ecuadorian settlers from the mainland. It is noteworthy that on Indefatigable (or Santa Cruz) there

▲ CACTUS and scraggy brush cover the coastal belt. The Galápagos are volcanic in origin. The climate is healthful

▼ TOP SPEED: 360 yards an hour. The giant tortoise is almost oblivious to sound, but its sight is keener

exists a small isolated Norwegian colony.

The Galápagos Islands are composed throughout of volcanic rock, and Charles Darwin states that the number of volcanoes he found on the islands exceeded 2000. However, nearly all of these are extinct, and eruptions occur only on Albemarle and Narborough (or Fernandina) Islands.

The climate is tempered by the cooling influence of the Humboldt Current; and the absence of malaria, poisonous snakes, and other tropical drawbacks makes the islands ideally healthful. Another favorable characteristic caused by the Humboldt Current is the abundance of fishes, which have caused these waters to become the permanent haunt of a large fishing fleet from California.

The archipelago has gained fame in the scientific world because of its fantastic fauna and flora. Darwin visited the islands on his around-the-world cruise in the "Beagle," and the observations he made there

▲ Upside down. When the giant tortoise withdraws into its shell, the air is pressed out of its lungs with a hissing sound "like an echo from prehistoric ages"

were of the greatest importance to the development of his epoch-making theory of evolution. Since Darwin's visit, a great many other scientific expeditions, mainly American, have explored the islands.

The best-known representatives of the Galápagos fauna are no doubt the giant tortoises known in the Spanish language as "galápagos," for which the islands have been named. Once upon a time these strange reptiles abounded in all the islands, but with the appearance of pirates and whalers in the Pacific, they were killed off in large numbers and stored as provisions aboard ship. In 1814, the famous sea captain David Porter reported that whalers passing the islands made it a practice to capture 200 to 300 of these tortoises and store them in the hold. They could survive for a whole year without food or water and served as a supply of fresh meat. When at last they were killed, they had lost nothing of their fatness or flavor. Enormous numbers were killed and carried away from the islands. Between 1811 and 1884, an estimated 16,000 were taken by whalers, according to the well-known biologist, Charles H. Townsend. Little is known of the numbers killed by buccaneers or those killed on the spot for their oil, which Captain Porter described as being far superior to olive oil in taste. At the end of the nineteenth and beginning of the twentieth centuries, actual expeditions were fitted out to capture and slaughter the defenseless giant tortoises to obtain the oil.

But great as the destruction no doubt was, it is safe to assume that the more serious reduction in numbers has been caused by the introduction of other creatures hostile to the existence of the tortoise. The rats, dogs, and pigs brought to the islands by man multiplied in an incredibly prolific way and were dis-

▲ The giant tortoise moves like a tank and is well protected. But eggs and young are very vulnerable to rats, dogs, and pigs

▼ If you catch a sea iguana, two jets of aqueous vapor will issue from its nose. But the creature is harmless and will not even try to bite

astrous to the tortoise, since they fed on the eggs and young soft-shelled animals. On some of the islands the giant tortoise has already become extinct. It is only in the interior of Indefatigable (or Santa Cruz) and Albemarle Islands that one can still find them in larger numbers.

The photographs illustrating this article were taken on the island of Indefatigable. During the last war, when the United States had a military base on Seymour Island, reconnaissance flights were made all over the archipelago to locate fresh-water sources. When circling over a steppelike region of Indefatigable, a few bodies of water were spotted, and in and around these pools large groups of tortoises were also discovered. Following the indications of the airmen, some of the island settlers made an expedition inland and found a large number of record-size tortoises feeding on the plains and taking mud baths in the shallow water. The settlers have been wise enough to keep this discovery to themselves, but knowing that the author's hunt would be a bloodless one—his only weapon being a camera—they gave information regarding the exact location of this colony of tortoises in exchange for a formal promise of secrecy.

To see these giant tortoises forcing their way through the brush is a most eerie sight. They walk slowly but relentlessly over the shrubs and the cacti at a top speed of 360 yards an hour, and their movement is strangely reminiscent of the mechanical action of a tank forcing its way through rough terrain. They seem almost impervious to sound; a gun can be fired behind them without causing any reaction. Their sight is keener than their hearing, and they can perceive the intruder from a long distance away, whereupon they snuggle their head and feet inside their shell. As they do this, the air is pressed out of their lungs with a hissing sound that is like an echo from prehistoric ages.

Once a year the females descend to the dry coastal region and dig in the red earth, where they deposit their eggs. The eggs are round and

▲ SLOW FREIGHT. Notice the bait, which actually works

▼ THE WORLD'S only marine iguana is about four feet long and looks like a holdover from the age of reptiles

▲ THE LAND IGUANA is not so mild tempered as its marine cousin. It can inflict serious bites with its strong-toothed jaws

▲ IF THIS IGUANA turned to bite, it could easily sink its teeth through its captor's boot leather

white, a bit bigger than a billiard ball, and are placed in layers of three to six eggs, in a hole a foot deep. The nest is then covered with a hard, easily recognizable crust. According to the Galápagos settlers with whom I spoke, the crust is formed by the mother tortoise, who, after having laid her eggs, soaks the earth with her urine.

Another very interesting Galápagos reptile is the world's only marine iguana, *Amblyrhynchus cristatus.* More than four feet long, this extremely ugly and prehistoric-looking lizard is completely harmless. If you catch an *Amblyrhynchus,* it will not even try to bite you; it will only nod its head angrily and spout from its nostrils two jets of aqueous vapor that make it look very much like a dragon. However, if it succeeds in escaping between the rugged lava boulders of which the seashore is composed, there is very little hope of catching it. It digs its twenty sharp claws into the porosities of the rock and inflates its body at the same time, so that no matter how one may pull and heave, the iguana holds on as though in a vise.

The sea iguanas are so unafraid of man that they barely budge when one moves among them. They

◄ THE LAND IGUANA will even eat a cactus pad bristling with needle-like thorns appear on the black lava shores in colonies, sometimes numbering thousands. When the tide is high, they usually lie around lazily basking in the sun, but at low tide they slowly creep down to the shore to feed on the seaweed and algae left uncovered by the receding sea.

Although sea iguanas dive and swim with great skill, they are not often seen in the water. Their worst enemies are the herds of wild dogs and the sharks, and not infrequently one may see specimens with bitten-off tails.

Amblyrhynchus has a cousin of about the same size on terra firma – the beautifully-colored *Conolophus subcristatus,* whose temper is definitely less gentle and mild. In some places they still exist in large numbers, but in others they have been decimated by men and dogs. For the most part they are to be seen lazily vegetating in the shadow of a big opuntia or strolling around feeding on leaves and flowers. They feed even on the opuntia leaves, which have thorns that resemble darning needles. If one disturbs their activities, they nod in protest and occasionally hurry off at a ridiculous gait with their legs spread wide apart, to hide in their holes under a stone or in the earth. If caught, they angrily try to bite with their strong-toothed jaws and can inflict a serious wound. One angry *Conopholus* bit right through one of my boots.

The only other reptiles of the Galápagos are some lesser lizards, a harmless snake, and the sea turtles.

The outlook for the Galápagos reptiles is gloomy; they are diminishing at a disastrous rate. At the time of writing there is a project underfoot, initiated by both Ecuadorians and Americans, which proposes to have at least some of the islands declared national parks. It is to be hoped that this excellent plan will be carried out before more irreparable damage is done.

The strangeness of these isolated volcanic islands and their almost incredible fauna and flora should stir everyone to support a plan to protect them from further inroads.

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have a strong suspicion that the mysterious night bird was a Cayenne Crake, a member of the family of rails, water hens, gallinules, and their immediate allies. There are not many birds in South America of nocturnal activity that would be capable of such performance as she describes, and this rail is one of them.

My particular reason for this identification is, however, my own experience in Peru a good many years ago. While camped in the forest, I had heard a mysterious voice on numerous occasions but was never able to catch the singer at work. My journal mentions the song as a succession of single tremolo notes on a rising scale of neither quite half nor full chromatic interval. I do not recall that the song ascended as high as Mrs. Irwin specifies, but my memory may be at fault in this particular. At any rate, on going over in my mind the birds that I knew existed in the region where I was camped, I became convinced that this rail was the most likely candidate for the honor of authorship of the midnight song.

Eventually I fell into conversation with an intelligent native whom I had found on previous occasions to be well informed concerning local wildlife. He recognized my description of the song and promised to bring me one of the birds at the first opportunity. When he arrived at my camp one morning with the bird, it was the rail I had suspected. I have confidence that the man was quite reliable in his identification, but I still confess to my failure to link the bird and its song by personal observation.

That Mrs. Irwin did not hear this rail, if it was the bird she heard, in Panama, Colombia, or Trinidad may be explained by the fact that it is quite absent from Panama and Trinidad and rare and of limited distribution in Colombia.

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How Much Is a National Park Worth?

In their efforts to invade the national parks, the exploiters, when brought to task by those who prefer to see these areas preserved for the recreational, cultural, and spiritual well-being of the public, fall back to a defense line based upon dollar values, according to the Wildlife Management Institute. Just what, in terms of dollars and cents, are Yellowstone, Glacier, and Grand Canyon National Parks worth?

Bureau of Reclamation engineers are able, through the magic of the slide rule and comptometer, to determine within fractions the potential output in kilowatt hours of power of a given park dam site, the storage capacity of the reservoir, and the dollars-and-cents value of the commodity produced, and say, "This is the value of the dam." Their opponents can counter only with intangibles. Although an application of the same logic would reduce the value of the Declaration of Independence to two dollars worth of parchment and a fraction of a penny's worth of ink, some tangible figures might be obtained. The defense line is a stiff one when backed by the carefully molded public opinion of the local people who will receive, or who have been led to believe they will receive, all of the material benefits of the construction work undertaken at public expense.

A little-publicized attempt to attack this line in one threatened national park disclosed some interesting information on the material value of the park to the people of Montana. This economic study was undertaken during 1949 at Glacier National Park by Harold Hoflich, a student at Texas A. and M. College, and M. E. Beatty, park naturalist.

It indicated that, in Montana alone, the average visitor spent $39 in 1949. A total of 480,000 visitors spent $20 million in Montana. Since 75 per cent of these people came specifically to see Glacier, the minimum value they placed upon the park was $15 million. This $15 million annual yield to the state of Montana represents an investment, computed at 4 per cent, with a minimum value of $375 million. If figures on expenditures outside Montana had been obtained, the material worth of Glacier to the entire United States would probably be double this amount. Even partial destruction of the park by the construction of dams undoubtedly would result in a much lower income from tourists to the people of the Flathead Valley.

Introduced Weed Provides New Penalties for Land Abuse

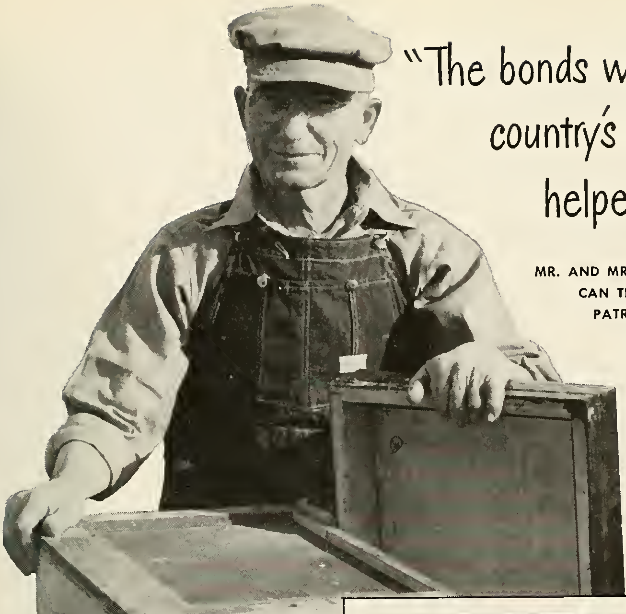
By Richard H. Pough
*Chairman, Conservation Dept.,
American Museum of Natural History*

CONSIDERABLE publicity has been given recently to the serious losses of sheep that a newly introduced plant—*Halogeten glomeratus*—has been causing in the West. Like the ubiquitous Russian thistle which was introduced years ago, it is an Asiatic annual belonging to the Goosefoot family. Apparently this dangerous exotic came over in a shipment of grass seed from Central Asia. Its presence was first detected near Wells, Nevada, in 1935. This nondeportable alien is now estimated to have infested over half a million acres from south-central Montana to northeastern California, the heaviest infestations occurring in northern Nevada and Utah and southern Idaho.

Tolerant of saline or alkaline soils and a prolific seed producer, Halogeten thrives in arid country wherever it can find open ground where its seedlings will not be subjected to competition from well-established perennial grasses and other plants. When its foliage dries in the fall, it may have an oxalate content—mostly sodium oxalate—as high as eighteen per cent, and ten ounces is generally sufficient to kill a full-grown sheep. Death results from the removal of the animal's blood calcium through the formation of relatively insoluble calcium oxalate deposited in crystalline form in the kidneys. Halogeten does not appear to be particularly palatable to livestock at any time; but on overstocked ranges where food is scarce it becomes acceptable, especially to sheep, in the fall when its foliage has dried and it is most deadly.

The value of the land subject to Halogeten infestation is too low to justify such relatively expensive methods as chemical or mechanical control even if they could be perfected. Biological control is therefore the only feasible method. Fortunately, this requires nothing beyond what we already know we should be doing in order that these lands may make their maximum contribution to watershed protection and produce the maximum amount of palatable forage for livestock. In some ways Halogeten may be a blessing in disguise, for it attaches a new penalty to overgrazing of the normally long-lived perennial grasses and to failure to promptly reseed eroded, disturbed, or disastrously overgrazed areas. Unfortunately, the 180,000,000 acres of public land now administered by the Bureau of Land Management have been subjected to such abuse in the past that it is estimated that the bill for their rehabilitation will run over $430,000,000.

Who is to pay it? The stockmen who use these lands? No, you and your fellow-taxpayers who own them and let the stockmen use them for a grazing fee that is only a fraction of what a private owner would charge.



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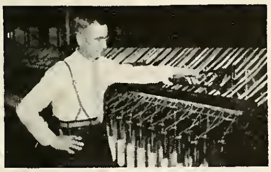

Mr. Whatley says, "My wife and I bought our first bonds in 1943, through the Payroll Savings Plan at the Martha Mills plant of the B. F. Goodrich Co. in Thomaston. Our pay averaged $40 a week apiece and we put about a quarter of that amount into U. S. Savings Bonds."

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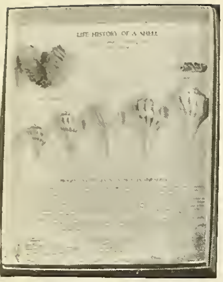
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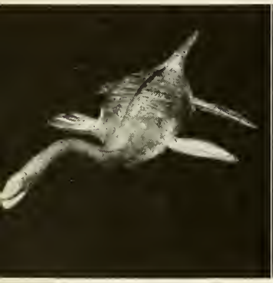

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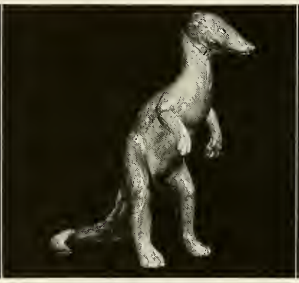

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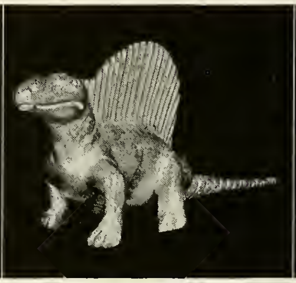

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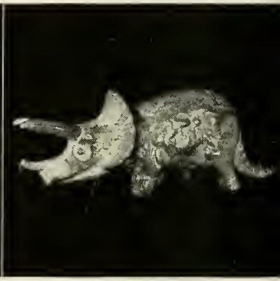

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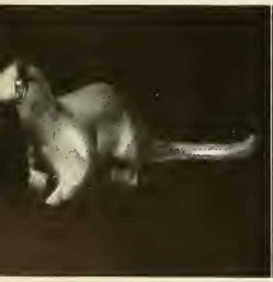

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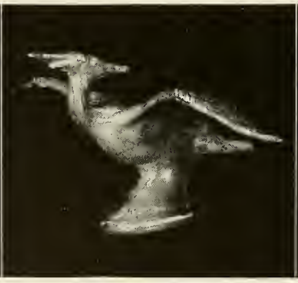

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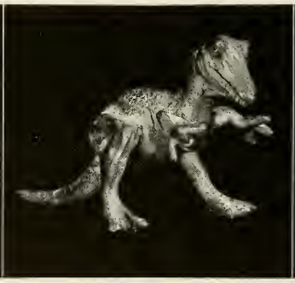

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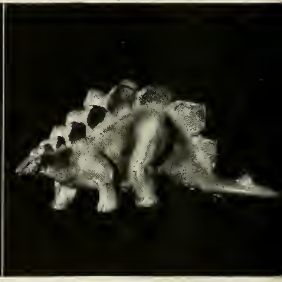

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LETTERS

Swan Song

SIRS:

Does a swan sing a "swan song" when about to die? I wouldn't have believed this until I read *Birds of America,* edited by T. Gilbert Pearson and John Burroughs, published by the Garden City Press. Part of the section concerning the Whistling Swan (written by E. H. Forbush) reads:

"The song of the dying swan has been regarded as a pleasing myth for many years, but Elliot asserts that he heard it once at Currituck Sound, when a swan, mortally wounded in the air, came sailing slowly down and began its death-song, continuing it until it reached the water. . . . It (the song) was plaintive and musical and sounded at times like the slow running of an octave. Inquiry among local gunners revealed the fact that some had heard similar sounds from swans that had been fatally hurt."

But the book never says whether the "swan song" legend is true or not. I don't think either tale is true. But if I'm right, what started these tales in the first place? Are they based on a grain of truth?

ALFRED THOMAS

Essex, Conn.

The following comments are offered by Dr. John T. Zimmer of the American Muesum's Bird Department:

The "song of the dying swan" has never been adequately explained and has usually been considered a myth with no foundation in actual occurrence. Daniel G. Elliot, however, was a careful and accurate observer, and his report of hearing such a performance cannot be dismissed. If he heard such a song, it must have a real existence. The question remains as to its possible explanation.

The trachea, or wind pipe, of some of the swans is a strongly convoluted tube whose trumpet-like shape presumably aids in producing the resonant calls of the species that possess it. It is possible to believe that a milder passage of air through the vocal apparatus than usually occurs would result in a softer musical note. A dying bird, then, under conditions of waning energy but still attempting to

▼ A MUTE SWAN on a private pond near Boston, Mass. This is the common "tame" swan—a species originally introduced from Europe

Ewing Galloway photo

sound its clarion call, might produce the plaintive death-song described by Elliot. It might happen that the trachea was perforated by the shot, preventing a full column of air from reaching the syrinx, or "voice box." Perhaps, instead, the syrinx was broken and unable to function to its normal degree, or the only possible notes might be those produced by the trumpet-like trachea.

In any case, "swan songs" may have a perfectly natural explanation, although they are of such rare occurrence that study of them has still to be made. In view of Elliot's observation, they cannot be wholly discounted as pure invention.

Bald Eagle Protection

Representative Homer Angell of Oregon has reintroduced a bill (H.R. 1870) in Congress to extend Federal protection to the bald eagle in Alaska, the Wildlife Management Institute reports.

Although the killing of an eagle carries a minimum fine of $50 in the U. S. proper, the same act pays the hunter a two-dollar bounty if it occurs in Alaska. In spite of the fact that there is no scientific evidence to indicate that the eagle kills many unspawned salmon, the bounty has been maintained for many years because the bird has been regarded by salmon fishermen as destructive of valuable fish. Of recent years, opposition to protective legislation also has come from many in the territory who profit from the bounty. During the past year, bounties were paid for 4,320 eagles, nearly double the 1949 total. The eagle in Alaska and elsewhere will take dead fish in preference to live ones, and around any spawning bed there are enough spent salmon to fill the craws of a great number of scavengers.

A bill similar to H.R. 1870, introduced in the last session of Congress by Mr. Angell, failed to pass in spite of the testimony in its favor by numerous leading ornithologists and conservationists.

AMNH photo

▲ THE BALD EAGLE, for which conservation groups are seeking federal protection in Alaska. Killing it now brings a fine in the States and a bounty in Alaska

Shell Trading

SIRS:

I have just begun to collect seashells here in Malta and would like to get in touch with anybody who would like to exchange foreign shells for local ones. As yet, I barely know anything about our seashells, but in time I hope to get to know all the kinds to be found around our tiny island.

EDWARD JAMES TURNER

Faculty of Medicine and Surgery,
Royal University of Malta

Last Month's Editorial

In response to the editorial "Freedom and the Scientific Press," one reader called it communist propaganda, another said it was anti-communist, and a number of others made complimentary remarks about it.—ED.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

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THE COVER THIS MONTH

This Navaho weaver, with her characteristic silver belt, squash-blossom necklace, and "spider" pendant, is spinning wool for her blanket in the background.

In early times the Navahos probably wore garments of buckskin and robes of buffalo. With the arrival of the Spanish in 1540, they began raising sheep and learned to weave. They wore woolen garments to some extent before adopting their striking modern costume made from richly colored velvets and other trade goods.

They remain famous, of course, for their beautifully patterned wool blankets. For these they wash the wool from their sheep by pouring over it hot water containing an extract of yucca root. The carding is done with a pair of ordinary European hand cards. Various vegetable dyes that were originally used by the Navahos for coloring buckskin and basket materials were for a time employed in some of the yarns for their blankets. But in recent years, the use of aniline dyes has become nearly universal.

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PATTERNS OF SEXUAL BEHAVIOR

- - - - - - by Clellan S. Ford and Frank A. Beach

Harper & Bros. and Paul B. Hoeber, Inc., $4.50, 307 pp.

THE publication of *Patterns of Sexual Behavior* is an important event. It is the first time, to my knowledge, that a nontechnical book on the biological and cultural interpretation of sexual behavior has been addressed to the general reader. I am not overlooking the numerous "sex" books that have appeared in the past. Such books, at their best, have simply provided descriptive accounts of human sex behavior to serve as guides to the bewildered, or they have dealt with various physiological aspects of sexual behavior in man.

Ford and Beach, however, have set quite a different aim for their book. Recognizing the variations of sexual experience within a single cultural context, so overwhelmingly demonstrated statistically by Kinsey and his co-workers, they have undertaken the enormously important task of understanding their significance. To do this they adopted a method that included a cross-cultural study of 190 contemporary societies, a comparison with subhuman primates and other mammals, and an analysis of the physiological factors involved. The impact of all this is truly impressive and novel.

We have known for a long time now that social conditioning affects human conduct and creates norms of acceptable custom, but for the first time Ford and Beach show unequivocally that sexual behavior also obeys the same directives. This very lability of sexual behavior in man is especially noteworthy and constitutes an important characteristic of human sexual behavior, which the authors find highly significant in understanding its evolution.

By comparing human patterns of sexual conduct with those of other mammals, the basic similarities and the essential differences are emphasized. Thus the emergence, or even the evolution, of human patterns becomes evident. The authors find an increasing freedom from purely hormonal control of sexual behavior as one advances in the mammalian sequence. The process seems to have reached its greatest development in the human species, where the role of the nervous system often overrides the endocrine basis for such behavior.

In very plain language, the authors describe in full detail the various aspects of sex, drawing upon a rich storehouse of experiment and observation. Their speculations are judicious and cogently presented, but without dogmatism. Throughout they display an open-mindedness that disarms criticism.

Nevertheless, one might raise several questions. For example, little or no statistical evidence is given for the normative sex behavior attributed to the various societies examined. Is the information drawn from one informant or a dozen? Moreover, in the light of the diversity found in our own society, how far can one go in defining the sex pattern of a particular community? These queries, of course, do not affect the fundamental thesis of the book, even though they might conceivably alter certain details.

Stressing as it does the relativity of sexual behavior, a book of this kind opens the way for a discussion of the value judgments that our society or any other places upon certain types of sexual practice. The authors disclaim any intent to enter that thorny field. Perhaps they were right; but since their book cannot fail to open these issues, it might not have been out of place to consider the social consequences of their research.

Patterns of Sexual Behavior is a model of clear, vigorous exposition. It gives a subject that our society has tended not to give the full light-of-day treatment. It deserves a wide and serious reading.

H. L. SHAPIRO

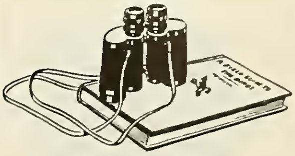
WATER—OR YOUR LIFE

- - - - - - by Arthur H. Carhart

J. B. Lippincott Co., $3.50
312 pp.

THIS book deals with water as a natural resource. Interesting statistics are presented on the over-all pattern of rainfall and what becomes of it. Much emphasis is given to man's dependence on clean water and in per capita quantities that become ever greater as his standard of living and degree of industrialization increase. A brief historical background deals with droughts, climate cycles, and past cultures. Rain making and elementary meteorology also come in for mention.

The growing water shortages that have occurred from coast to coast in recent years provide a background of urgency for this book. Having polluted our surface waters, we have turned to underground supplies, only to find that there are sharp



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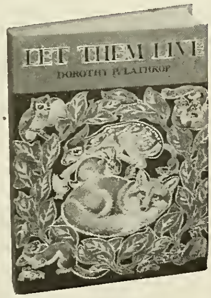

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LET THEM LIVE

By DOROTHY P. LATHROP
Illustrated by the author

MACMILLAN

limits to the quantities of water they can provide. In short, the author makes it quite apparent that to date our efforts to meet our growing water shortages have been somewhat less than sensible. Instead of cleaning up and using near-by streams, we spend millions to tap distant sources of water for our cities. Instead of putting our watersheds into condition to hold water, we spend vast sums in a losing fight to strait-jacket our rivers with higher and higher flood protection dykes. According to Mr. Carhart, the present plans of the Bureau of Reclamation and the Army Engineers would, if carried out, constitute the greatest folly of all. To irrigate at most 19 million acres of additional western land, these agencies propose to spend an estimated $53 billion of public funds on projects of questionable economic soundness and most projects to date have greatly exceeded preliminary estimates. A fraction of this amount would go far toward saving most if not all of the half-million acres that go out of cultivation every year due to soil erosion and the many millions more that continue to decline in productivity for lack of proper care.

Although recognizing the needs of our industrial age, Mr. Carhart is a man who feels strongly about the importance of leaving more of our country as God made it. Clean streams, which provide suitable homes for trout and salmon, and dam-free mountain valleys and canyons, which delight the eye with their quiet beauty, are in his opinion national assets to be cherished and preserved as long as possible.

RICHARD H. POUGH

GALLERY OF AMERICAN DOGS

- - - - - - - Text by Harry Miller

Photographs by Arthur S. and Katherine Holt Mawhinney

Pen-and-ink drawings by Paul Brown

McGraw-Hill Book Co., $7.50
262 pp., 120 gravures,
119 pen-and-ink drawings

FROM December 14, 1941, to January 4, 1942, there was an exhibit in the American Museum of Natural History of a series of remarkable dog portraits. These photographs were so outstanding that I visited this exhibit a number of times during its all-too-brief stay. Others, too, were enthusiastic. A friend of mine was admiring the photographs and said he wished the set could be published so that he and others could always enjoy them. Fortunately this has at last been accomplished in *Gallery of American Dogs.* Although not all the pictures in the exhibit are contained in this volume, I recognized many, and there are numerous new ones.

This book consists of superb portraits of 128 breeds of dogs, including 113 recognized by the American Kennel Club. Arthur S. Mawhinney and Katherine Holt Mawhinney, who are considered among the best of dog photographers, took the pictures. Twelve years of arduous labor were spent in securing this set.

The author, Harry Miller, is well qualified to write the text accompanying each portrait. Mr. Miller was originally a newspaper man, but his interest in dogs led him to work with them, and he is now Director of the Gaines Dog Research Center. Although the text for each portrait is necessarily short, the information is well chosen and authoritative.

At the foot of each page of text description, there is a well-executed pen-and-ink sketch by Paul Brown, giving the reader a portrayal of the conformation of the entire animal.

This book should be on the shelf, not only of every dog lover, but also of every person interested in fine photography.

T. DONALD CARTER

THE AUDUBON BOOK OF BIRD CARVING

- - - - - - - - - by John L. Lacey
as told to Tom Moore McBride

McGraw-Hill Book Co., $3.50
124 pp., 50 illusts.

FOR the person interested in birds and having a desire to make three dimensional lifelike models of them, this very practical guide will be found invaluable. Modeling with plastiline, making a plaster mold without knowledge of the important parting lines, and finally making a good cast has often ended in frustration.

This is just the book for the amateur who, with step-by-step procedure, will be able to enjoy the satisfaction of doing creative artwork. It was not written for the professional or practicing wood carver.

Many authors tend to confuse the beginner by introducing too great a variety of artistic concepts and too many different techniques. Birdsmith Lacey makes no attempt to display a large knowledge of the artistic or the technical aspects of woodcarving. Because of its very limit in scope, this volume is more clear and usable.

Mr. Lacey helps the reader to choose the most practical wood and proper tools; he does not limit him as to the kind of bird to be carved but does insist on single procedure in working. He explains when and how to use each tool recommended.

There are full sets of designs for various types of birds with minute directions for their use. Instructions are given in detail on surface finish, color, and final display. Mr. Lacey has an unusually good understanding of the beginner's problems and needs. Without fuss he starts his directions at the very outset of the task and does not quit until he and his reader have produced together an acceptable model of a bird. However inexperienced the student may be, success will be assured since all pitfalls have been carefully avoided, and the finished carving will contain much of the knowledge and know-how Mr. Lacey has gone to some pains to accumulate.

Mr. Lacey has been a bird lover since childhood and as such has shown a very keen and observing interest. He was raised in Spoon River County of south central Illinois, a region still abundant in wildlife. I think many hobbyists, bird lovers, and sportsmen alike will welcome this book and through it spend pleasant and profitable hours.

GEORGE E. PETERSEN

HOW ABOUT THE WEATHER?

- - - - - by Robert Moore Fisher

Harper & Bros., $3.00
186 pp., 16 plates

ENOUGH books have been written for the layman on weather and its prediction to stock a sizable library. While some of these fulfill the purpose for which they were published, many are as hazy as some of the weather they describe. This volume, which explains weather facts logically and coherently, definitely belongs to the former category.

The first eight of its twelve chapters review the elements that combine to produce weather and prepare the reader for Chapter 9, "How to Interpret the Newspaper Weather Maps." Illustrated with three series of weather maps for the United States, indicating the day-to-day changes in the weather pattern, this is a worthy contribution to the education of the lay reader.

In addition to this basic material, the book also contains a generous assortment of useful and amusing facts that will prove interesting to any outdoor enthusiast. These include a formula for determining the temperature by counting the number of cricket chirps per minute, and another for estimating the distance of lightning.

Chapter 12, "Forecasting the Weather: How to be Your Own Ground Hog," provides useful hints for guessing tomorrow's weather by studying the weather map and recognizing the meaning of various "atmospheric signals."

In the appendices one can find out how to estimate the speed of the wind and learn many pertinent facts of value in interpreting signs in the sky. The book also contains a good bibliography and a list of facts and figures of practical value to the amateur meteorologist.

All in all, it is as good a book on weather for the nonscientific reader as we have read in several years.

ROBERT R. COLES

THE MOA-HUNTER PERIOD OF MAORI CULTURE

- - - - - - - - - - - - by Roger Duff

Whitcombe and Tombs,
Wellington, New Zealand
405 pp., 38 plates, 60 figs.

ALTHOUGH the traditions and the genealogies of the Polynesians suggest that they have been resident in the eastern Pacific for 1500 years or more, their culture as it is usually presented has a peculiarly static quality, like something frozen in a fairy tale disconnected from the rest of the world and unchanging in time. This has, in large measure, been the result of a lack of archaeological depth in the study of Polynesian culture. In most of the islands only the life that existed at the time of European contact has been available for study. The historical changes that must have occurred during the long period that the islands were occupied before the coming of the Europeans have remained hidden from view. As a consequence, interisland relationships, population movements, and cultural diffusion—in short, the history of Polynesia has been rendered unduly difficult to establish.

Only in New Zealand has anything like historical depth emerged. Here the association of cultural remains with the bones of the extinct moa, a large flightless bird, provided the clue. The accumulation of data from a number of excavations, together with the careful appraisal of the Wairau site on the east coast of the South Island, has provided Mr. Duff with sufficient material to reconstruct a very cogent

Continued on page 287

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Ivan Mashek photo

▲ THE MAN WITH THE TROWEL: Dr. Jesse Nusbaum, who saw that science was to be dealt a serious blow. Irreparable damage could be prevented only if the bulldozers could be preceded by scientific diggers

BULLDOZERS VS. Trowels

A pipeline in the Southwest would benefit thousands of people, but it would also destroy scores of prehistoric sites vital to the reconstruction of man's past. Time was running out when one lone scientist challenged the juggernaut

By DEAN FREIDAY

LAST July 15, it was announced that construction would begin in two weeks on a 451-mile natural gas pipeline from Barker Canyon Dome in northwestern New Mexico to Topock, Arizona, in the Mohave Desert. This project would bring benefits to many communities, but in the same stroke, it was going to deal the science of archaeology a severe blow. A 60-foot right of way was to be cut through an area rich in prehistoric remains. Bulldozers and ditching machines would begin grinding up pit houses, kivas, even entire pueblos.

Forty-four years of familiarity with Southwestern archaeology had made Dr. Jesse L. Nusbaum aware of the damage that would be done. Apparently no one else was prepared to protect the prehistoric sites involved.

Amateur diggers used to be the major threat to prehistoric remains. Souvenir collecting was the main cause of damage. "Pothunters," unaware that digging into ruins for pottery or arrowheads disturbed the stratification that is essential to scientific excavation, had become such a menace that Congress passed in 1906 an Act for the Preservation of American Antiquities.

The Act restricted excavation on public lands to competent organizations, and it authorized the establishment of National Monuments for the preservation of areas of historic or prehistoric importance to the Nation. The Act was passed just in time to save the celebrated Pueblo Bonito from destruction, but the problem continued. Lack of policing outside of National Park Service areas and general unconcern for the damage being done made the Act only partially effective.

The development of large earth-moving machines and major construction projects multiplied the damage and loss alarmingly. Private landowners leveled most of the great prehistoric irrigation system developed on the desert floor of the Salt River Valley. Five prehistoric open-pit turquoise mines were obliterated during construction of Hoover Dam on the Colorado River, and scores of sites disappeared forever when the waters began to rise behind it.

Growing recognition of the emergent need for rescuing the valuable archaeological materials in sites destined to be flooded and lost behind the hundreds of dams that Federal agencies were planning and constructing throughout

Photos courtesy El Paso Natural Gas Co.

▲ THE HUGE ditching machine on the San Juan Project. When archaeologists became alarmed at the destruction this pipeline would cause, this machine was about to begin its 451-mile trench

➤ SWIFT LAST-MINUTE NEGOTIATIONS resulted in an agreement by the El Paso Natural Gas Company to permit the archaeological work and even to bear the cost. Here the bulldozer crew pauses to inspect the excavating of a Sinagua pit dwelling in Arizona before by-passing the site

the United States found expression in the formation of a government agency in 1945. This was known as the River Basin Survey. It was under the supervision of the Smithsonian Institution in collaboration with the National Park Service.

But the damage continued in other quarters. A contractor leveled a complete pueblo in the construction of U. S. Highway 66 in western New Mexico and used the material for road fill. Until the Secretary of the Interior intervened in 1939—following vigorous protests—road construction on Indian Reservations had been permitted to damage and destroy scores of archaeologic sites.

All these were of minor importance compared to what would be done in the construction of this pipeline. Bulldozers weighing 23 to 28 tons, which stop for nothing but solid rock ledges, would start on the long path across New Mexico and Arizona. One-, two-, and three-toothed rippers would rip and break up the softer rock formation and lift huge boulders so they could be bulldozed out of the way. A 37½-ton revolving wheel ditcher would dig 2 miles of trench every day—3½ feet wide and 6 feet deep.

No one could object to a pipeline that would bring added comfort to thousands of homes through cheaper fuel, but it was equally hard to condone the avoidable destruction of irreplaceable archaeological treasures. Dr. Nusbaum, personally, was in no position to require the company to conform to the Antiquities Act. Construction was to begin on the Navaho Indian Reservation, and for 218 miles it would continue on Navaho lands. Authority to grant right of way, therefore, and to issue the preliminary construction permit had been delegated to the General Superintendent of the Reservation and the Chairman of the Navaho Tribal Council. Dr. Nusbaum therefore urged the Navaho Reservation officials to make the request, and assured them that he would back them up.

The request was made, and on its receipt, an official of the El Paso Natural Gas Company objected strenuously to this last-minute interference by Dr. Nusbaum when construction was almost started. The company's primary concern was that the archaeological work would delay construction. Time was of the essence, and each day's delay would cost the company about $7500, or as much as several hundred thousand dollars if it prevented completion of pipeline construction in the high-altitude country before heavy snowfall.

When it was explained to another official, Mr. C. L. Perkins, Vice President and General Superintendent of the company, that the archaeological work would not interfere with the progress of the

Photo courtesy El Paso Natural Gas Co.

▲ IN THE PATH of the pipeline, 146 sites were discovered. The construction men became expert at recognizing the signs of ancient habitation. More than once when the markers blew away, they knew enough to avoid the spot

▲ A RUIN THE PIPELINE DISCO
ERED. Careful mapping of th
buried buildings is an essenti

pipeline and that costly diversions would be kept to a minimum, it is a tribute to Dr. Nusbaum's diplomatic skill that the company agreed to allow the scientific work to be done in advance of construction. It is also to the company's lasting credit that it offered to bear the cost of this work. Earlier the company had agreed to shift the route south of the Hopi villages to avoid as many sites as possible. Chairman Sam Ahkeah, of the Navaho Tribal Council, and General Superintendent Harper, who approved the right of way across the reservation lands, were glad to leave it to Dr. Nusbaum's discretion to decide where the route should be further shifted to avoid ruins.

Now that the scientific work had been approved and the funds provided, the real difficulties began. An accelerated archaeological technique had to be worked out. Excavation is a slow, meticulous procedure in which each layer is carefully removed and the exact position of each object and structural feature recorded, so that its relationship can be reviewed even after the work has long been completed. Obviously full excavation had to be limited. Dr. Nusbaum was not so concerned about the damage by the ditching machine, for it would make a trench neither wide enough nor deep enough to obliterate more than a slice through a whole village or even a house. Most important was adequate excavation of the shallow sites that would be completely destroyed in bulldozing the 60-foot swath.

Two crews of two archaeologists each were assembled, and Fred Wendorf, a fifth man, was appointed supervisor. He was to manage the work of both crews and to help the crew that most needed it as the balance of the work shifted. This division was necessary, because the pipeline was constructed by 2 "spreads"—2 complete assemblages, each composed of about 300 men, 1000 tons of self-propelled and portable construction equipment, warehouses, repair shops, offices, and even airstrips. The company also provided air transportation for Dr. Nusbaum when his assistance or advice was necessary.

A surface survey was first made

Courtesy LIFE

art of modern archaeological ex-
avation. "Sidewalk superintend-
nts" watched even in the desert

Photo courtesy El Paso Natural Gas Co.

▲ POTENTIALLY MORE DESTRUCTIVE than the trenching machine were the bulldozers, which first cleared a path 60 feet wide. The trencher cut only 3½ feet wide and 3 feet deep by each archaeological crew. As soon as the right of way was staked, the crew walked ahead to determine what was in the path of the line. They covered up to ten or eleven miles a day, with eyes alerted for scattered potsherds, broken artifacts, surface evidence of structures, or the slight bowl-shaped depression that marked an underground house or kiva if wind-driven sediments or alluvium hadn't filled it. Since the bulldozers could also clear and grade ten or eleven miles of right of way a day in very favorable terrain, the crew often felt that the machines were juggernauts riding their heels. On several occasions, the archaeologists had just finished making the last measurements and photographs when the bulldozers arrived. It was a standing joke on the job that if the men didn't get their archaeological work done in time, they would themselves become archaeological material.

They recorded site locations on the survey sheets and indicated the evidence of type and age as told by the artifacts, together with any information discovered by sinking test pits where desirable.

They followed up the pipeline ditching machine and examined the trench walls for archaeological or geological profiles. Where a site had been hidden by volcanic ash from Sunset Crater, or by other detritus, it was revealed in the trench walls. In no case did the ditching machine cut deeply enough to disturb the floors of pit dwellings or kivas where the important archaeolgical material was likely to be found, and in only one instance did it cut through the floor of a small pueblo, buried under windblown sand. The scientists made measured sketch plans wherever structures could be observed.

The work was not without its hazards, as rattlesnakes frequently fell into the trenches; and when they were unable to get out, they were in a very unfriendly mood.

Only once was the pipeline actually diverted from its planned course to avoid an important site. In the balance of cases where remains were encountered, the sites were excavated on the spot. Even the bulldozer operators, accustomed only to look down upon the earth from their powerful perches, became interested. The archaeologists were surprised to see them examining the ground with unaccustomed minuteness. And several times when the markers that had been posted to indicate a valuable site had blown away, the operators of the big machines had learned enough to recognize the indications of "pay dirt" and took care to clear only part of the path. Wherever major excavation was necessary, the company furnished all the extra labor needed for the heavy work.

The company was not legally obliged to submit to archaeological supervision on the non-Federal lands within the right of way, but as the construction progressed, the importance of the scientific work became increasingly apparent and the company agreed to extend the coverage. It also contributed the funds necessary for the proper study of recovered materials and for the preparation of the scientific report on the results of this program. The Museum of Northern Arizona has agreed to publish this report.

The number of sites encountered was surprising—146 in all, 52 in New Mexico and 94 in Arizona. Of these, only thirteen were fully excavated. Beyond their sheer number, what did these sites mean?

Along Willow Creek, 50 miles west of Seligman, Arizona, 10 sites comprising more than 30 structures were located in an area whose archaeology had previously been unknown. Time range of the houses excavated extended from Basket Maker III, A.D. 500-700, to the post-Columbian Navaho hogans whose floor debris was also excavated.

Surface finds of Pinto-Basin-like artifacts dating back to 4000 B.C. were made, but unfortunately no structures were found underlying these. Five prepottery sites (before A.D. 500) were located. These yielded the earliest material along the route.

We know that man existed in the Southwest as early as 10,000 years ago, from a fairly clear series of sites not connected with this project. The farther back we go, the fainter the picture. Occasionally archaeologists discover a little additional evidence on this early period. Proper surveys, like the present one, may help locate that evidence. Only in this way can the danger of loss through unscientific excavation be averted.

A relatively rare type of site is one that reflects the lives of two different groups of people. It acts as a connecting link and demonstrates clearly the interrelationships between the cultures. Ten sites of this type were found by this survey, sites that were common to Colorado Plateau Cohonino and Colorado River Valley Patayan—two cultures, by the way, whose existence was unknown twenty years ago.

The pipeline survey had geologic value as well. In one place, the trenching machine cut through a sand dune, exposing five horizontal bands of caliche interspersed with equal or thicker layers of clean sand. This was clear evidence of five wet and five dry cycles, with many implications for the effect on human and plant life during those periods. According to Dr. Nusbaum, the critical fluctuations in water supply and their influence on the migrations of people have been one of the most important factors in the prehistory of the Southwest.

During the years of adequate water supply, the dry farmers of the area prospered. Their principal crops were corn and, in lesser measure, beans and squash. These they supplemented with limited gathering of native plant foods and hunting.

A few seasons of diminishing water supply would force them to seek more favorable situations. They became prodigious builders—and apparently built new dwellings wherever they moved.

There was only a limited number of locations where ideal year-around conditions existed. The

Continued on page 288

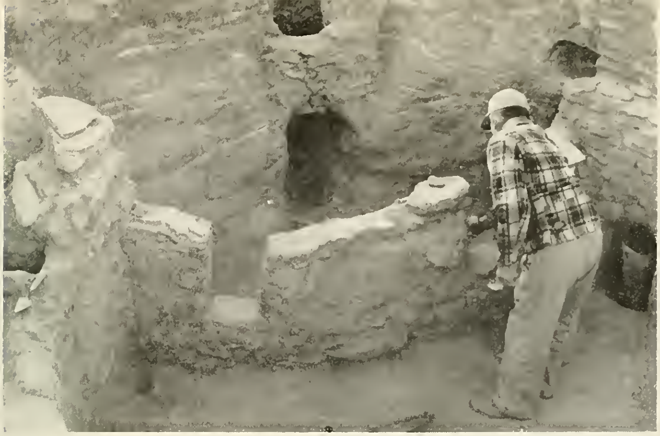

Photo courtesy El Paso Natural Gas Co.

◀ A TYPICAL Mesa Verde type kiva or ceremonial room of the Pueblo II period. It was deeply buried beneath wind-blown and water-borne material during the nine centuries since its use, so that the bulldozer only revealed its topmost wall. Note the outside flue and interior fire pit, separated by a low deflector wall with dual passageways

Photo courtesy El Paso Natural Gas Co.

▲ SOMETIMES the pipe skirted a buried dwelling, but it never caused serious damage. This Basket Maker III house of two chambers was occupied about 1300 years ago. No signs of it showed on the surface, for three feet of soil had accumulated above it during the intervening centuries

Courtesy LIFE

▲ DR. NUSBAUM and assistant brushing the dust of ages from the head of a primitive Indian

Photo courtesy El Paso Natural Gas Co.

➤ A LARGE RUIN of the early classical Pueblo III period, 114 feet by 74 feet. Above, Dr. Nusbaum is explaining excavation to a Company Engineer. Below, Francis Cassidy is discussing the job with a Caterpillar Foreman, who begged to be left on the archaeological work at $1.15 an hour rather than receive the regular $2.95, because he had never had the chance to search for ancient man

Centuries of abuse have brought our soils to the verge of ruin. The need

natural resources finds expression in the new Felix M. Warburg Memorial Hall, recently ope

Build a Healthy Acre

TO most people the term "ecology" is a sixty-four-dollar word that conveys little meaning. Actually its significance is comparatively simple. It means the relationship of plants, animals, and people to their environment and the alterations that occur in the environment from time to time through changes of season, rainfall, climate, and the influence of man himself. It is a science, and basically even a philosophy, which in the past has received too little attention in our whole system of education. It is basic because only out of the proper understanding of man's relationship to his surroundings can he eventually achieve health, prosperity, vigor, the means of relaxation, and indeed not only peace of mind for himself but peace with his neighbors. It is not too broad a statement to say that if the whole of the world were established upon a base of proper ecological understanding, the occasions for wars would be greatly diminished or even eliminated.

The new Felix M. Warburg Hall at the American Museum of Natural History is dedicated to ecology, and it is, so far as I know, the only exhibit in the world with ecological understanding as the basis of its conception. The Hall was made possible by members of the Warburg family as a memorial to that great philanthropist and citizen Felix M. Warburg. It was planned and carried through by Director Albert E. Parr and his co-workers on the staff of the great museum.

Both broadly and in the minute details, the greatest care has gone into the execution of the plans, for the over-all picture it creates is significant and the small points that contribute to making up the whole are vivid and challenging to either a school child or a distinguished scientist. Wisely Dr. Parr did not take the whole of the world or even of a state or a county as the base of his exhibit. He limited its borders to an area of 40 square miles around Pine Plains in Dutchess County, New York. It is significant that the area chosen for the exhibit is within easy distance of New York City itself so that an individual or school group may attend the exhibit, study it, and then in turn pay a visit to the Pine Plains area itself.

The treatment of the exhibit and its presentation are completely modern in approach and embody many new developments in museum presentation technique. Some of these, including the skillful use of reflecting mirrors to achieve depth and proper lighting in whole landscapes, have been worked out by Dr. Parr and his museum staff assistants. The results are remarkable.

The whole is presented in an understandable and interesting fashion, clearly but with no concessions to popular vulgarity. The captions for the exhibit and the individual texts are clear and simple. The new Hall is, indeed, a model of the whole new technique in presenting museum material, far removed from the old mud colors, the dust, and the obscurity of over-Latinized and too-scientific presentation.

The Pine Plains area chosen for study and presentation is pictured at the entrance to the Hall by a huge landscape showing the rich variety of the countryside. There are the swamps and marshes, the agricultural land, the ledges of decaying shale and granitic rock, the mounds of glacial till, the potholes, forests, undergrowth, and wildflower vegetation. From this over-all presentation, one progresses to the various exhibits in which the whole of the pattern of plants, animals, and people existing within that given area is broken down into detail, as if bit by bit the spectator were taking apart the landscape and examining it under a heavy magnifying glass or even a microscope.

Notable among the first stages of the breakdown is a series of five

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* LOUIS BROMFIELD is well known as a winner of the Pulitzer Prize and the author of 30 novels and other books. He is also one of our country's foremost exponents of good land use and a leading figure in the application of wise conservation in his own state of Ohio and elsewhere. On May 14, he gave an address at the American Museum of Natural History on the opening of this Hall.—ED.

national philosophy regarding

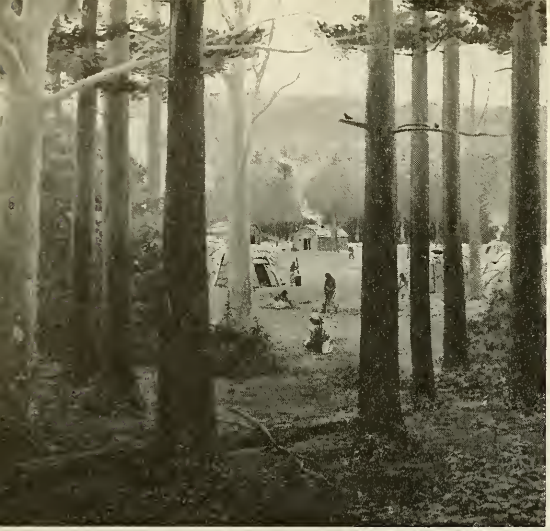
American Museum

By Louis Bromfield*

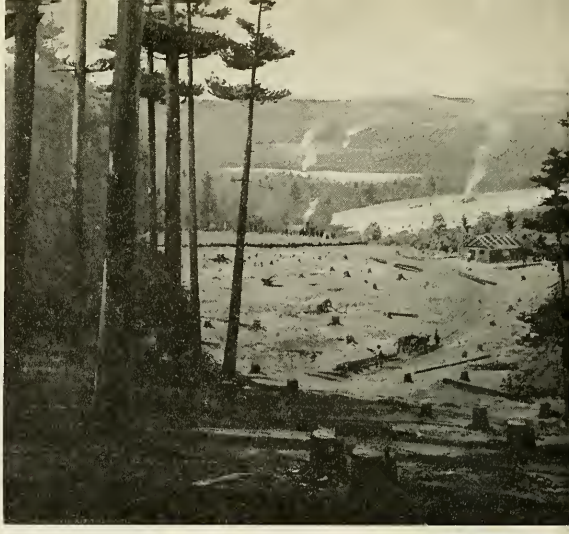
large panels showing the broad external picture of the forty-square-mile area at five stages of its development. The first of these shows the Primeval Forest, inhabited only by wild creatures and the half-wild Indians. The second shows the coming of the first white settlers in 1790. The third is the landscape in 1840, when the land has been cleared of forest and put to agriculture, with the abundant returns of freshly cleared virgin soil, undepleted and unspoiled by the hand of the white man. The fourth (1870) represents the beginning of the decline in fertility under an agriculture that took everything and returned little. Soil erosion and floodwaters were beginning to be disastrous, and the forest had begun to creep back, taking over the partially depleted fields with scrub and second-growth timber. The fifth panel represents the same landscape in 1950, when a whole new frontier is being established in which the pioneer's task is no longer the battle with Indians and the clearing of the forest but the restoration of the land damaged or ruined by the first tide of white man's management.

These five panels have a significance far beyond the limited area around Pine Plains, for they symbolize the history of the white man's invasion, exploitation, and destruction of natural resources throughout the whole country—perhaps the worst and most reckless example of

Entrance to
Felix M. Warburg Memorial Hall



The Primeval Forest



The Settlement 1790

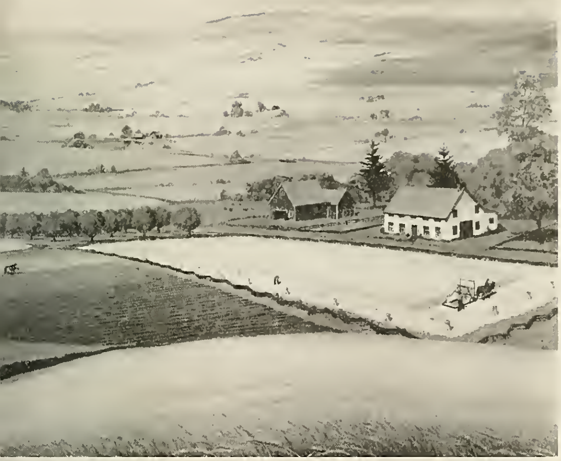
exploitation and destruction ever achieved by any nation at any period of history. They are a superb example of how man, through his lack of understanding of environment and nature, can endanger or destroy the very basis of his health, prosperity, and general well-being. The fifth panel, representing the area in our own day, is encouraging and even optimistic in tone. It shows how, through proper understanding of ecology, man can restore and rebuild a whole area to its old level of production and fertility and even create an abundance greater than that produced by the area when the first men put it to the plow.

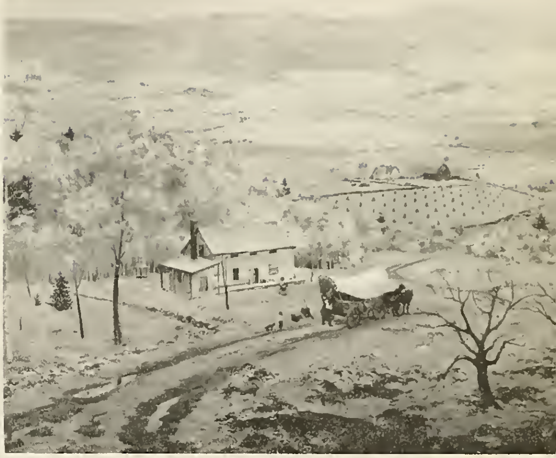
The first panel shows a kind of sylvan paradise occupied by the Indian who lived by hunting and the cultivation of corn, beans, and squash in an opening in the forest. The natural cycle of birth, growth, death, decay, and rebirth is scarcely disturbed at all, and the Indian himself is very nearly a wild creature. The third panel displays the same landscape after the white man has cleared away the forest and divided the area into square fields. Here he is reaping and destroying the abundance born of millions of years of birth, growth, death, decay, and rebirth, which the deep, rich topsoils represent. In the fourth panel are shown the ravages of greed and of the ignorance of natural laws upon the same landscape. It is already on the downgrade toward abandoned pastures, and the once fertile fields are being taken over again by the scrub growth of a returning forest. The fifth scene represents the beginning of the renaissance of the same landscape, with contoured fields and legume and grass crops, managed forests, and modern power machinery.

The five panels tell a striking story of what has happened and is happening to the whole of the nation; but above all, they depict the disaster that can overtake man when he ignores natural law, in contrast with the great blessings that can accrue when he understands and works with it. In an area badly exploited, the wildlife begins to disappear; the streams flood and turn muddy and in summer do not flow at all; the livestock grows bony and weak and nonproductive; the farmer and his family grow poor, both economically and physically; and the people living in remote cities begin to pay higher and higher prices for food of increasingly poorer quality.

In fact, the whole of the new Hall should be of greater interest to the city dweller than to the villager or farmer, for it dramatizes the relationship and the remote but fundamental dependence of the city dweller—so remote that he sometimes does not recognize it—upon the whole of nature and upon natural resources for his well-being and indeed his very existence.

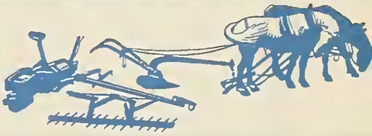
Beyond these five striking panels depicting development of the Pine Plains area, the region is again broken down into smaller segments. These reveal the relationship of living things, both plants and animals, to the soils and to the climatic conditions in which they exist. Some of these exhibits are striking in their verisimilitude, both in regard to the physical conditions and the plant and animal life. Segments of various soils have been removed by special techniques without disturbing in any way the exact pattern in which they were laid down by either glaciation or weathering and decay. It could be said that in truth the spectator goes underground and becomes a field mouse, chipmunk, mole, or yellow jacket. One becomes aware of the intense and compli-





The High Tide
1840

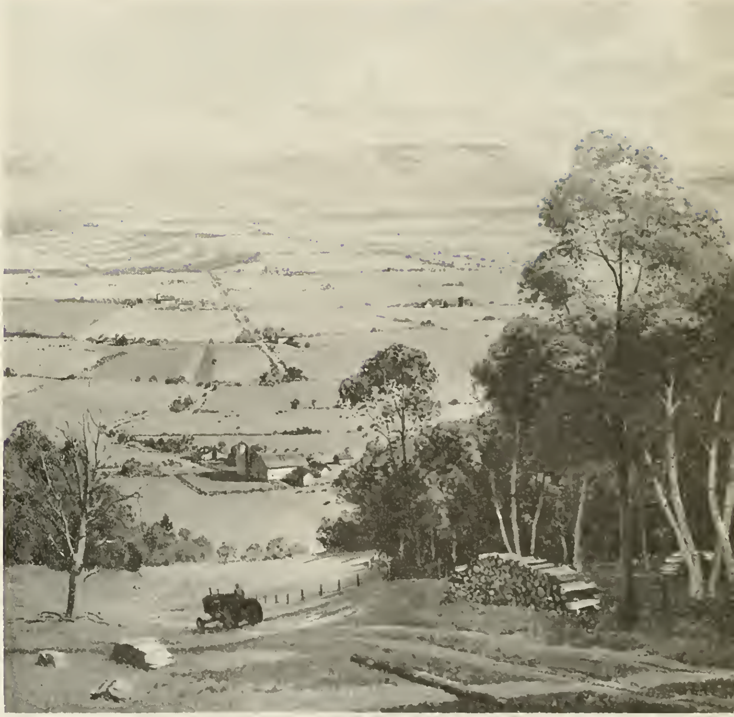
The Ebb
1870



cated life going on underground, which even the more experienced nature lover may sometimes ignore.

This is the summer underground nest of the yellow jacket, which in winter becomes the cozy home of the white-footed field mouse. One sees the humble earthworm working near the surface in the warm summer months, devouring the decaying leaves and grass and converting them into rich soil. One sees him buried and dormant during the winter months, far below the line where frost penetrates. Then there is the chipmunk sleeping through the winter in his warm and comfortable nest. One sees the leaves and the nuts he has gathered, partly to build his nest and partly to use as food if he wakes a little early in the spring and discovers that outside the food is still scarce. There is the complex metropolitan underground habitation of an ant colony. And, of course, unseen but noted, is the immense population, measurable only in trillions, of the benevolent bacteria, which are constantly at work converting what remains of dead animals, leaves, and twigs into the rich soil which in the end feeds all the life that continues.

One of the most striking exhibits



Today
1951

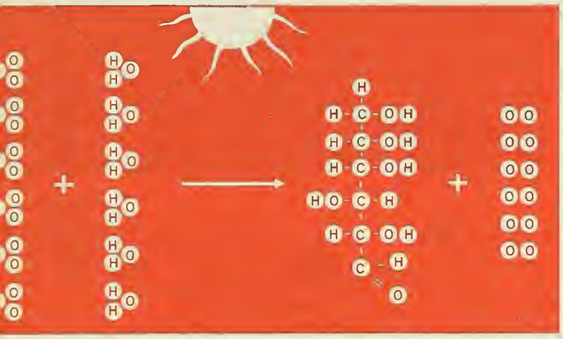
Cycle of Nutrition and Decay

One of the many subjects presented graphically in the new Felix M. Warburg Memorial Hall at the American Museum

PHOTOSYNTHESIS and RESPIRATION

▼ Sunlight shining on the green coloring matter in plants (chlorophyll) allows carbon dioxide and water to combine to form a molecule of sugar, in which energy is stored. This process, called *photosynthesis,* occurs only in green plants

▼ In the reverse process of *respiration,* the sugar is burned, giving off energy and leaving the inert substances—carbon dioxide and water—with which the process started. Respiration occurs in all plants and animals



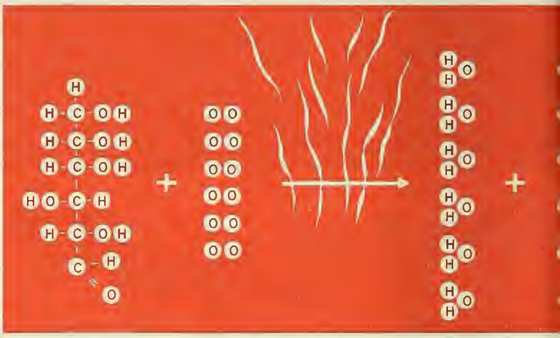
BON DIOX- molecules—(Two atoms xygen to one arbon)

WATER MOLECULES — H_2O (Two atoms of hydrogen to one of oxygen)

SUNLIGHT

SUGAR MOLECULE containing 12 atoms of hydrogen, 6 of oxygen, and 6 of carbon

12 ATOMS of oxygen left over as a by-product



A MOLECULE of sugar

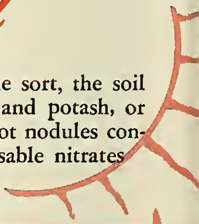
COMBINING with oxygen

BURNS — releasing the energy in the sugar as heat or power

THIS PROCESS yi carbon dioxide and ter as by-products

Fertilizers in the Soil

IN THE AUTUMN, man takes crops away, and unless he makes replacements of some sort, the soil becomes poor and useless. He adds commercial fertilizers such as phosphate, nitrates, and potash, or he may grow clover and alfalfa which he plows back into the soil. These plants have root nodules containing nitrogen-fixing bacteria, which take nitrogen from the air and turn it into usable nitrates



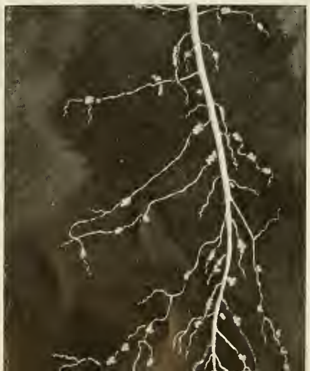
NITROGEN-FIXING BACTERIA

Bacteria enter the roots from the soil and establish themselves in cells in the root tissues. These cells become enlarged, and finally nodules are formed. The enclosed bacteria fix nitrogen into nitrates. These are released into the soil when the roots decay

Chlorophyll in the plants, when acted upon by sunlight, makes food

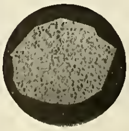
◄ Red clover plant

▼ Enlargement of Root Nodules

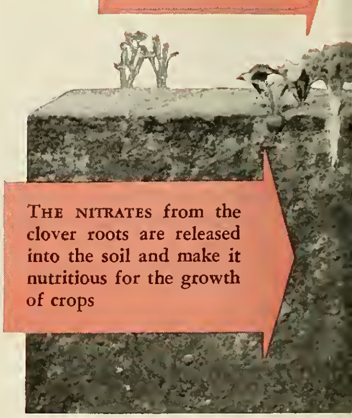


◄ One nodule, magnified

◄ Enlargement of cells in a nodule



◄ Bacteria within the cell, further magnified



The nitrates from the clover roots are released into the soil and make it nutritious for the growth of crops demonstrates why, once land comes under intensive cultivation and the products are removed and used or consumed elsewhere under a heavy drain, the natural balance of things becomes upset. It shows why it then becomes necessary to introduce into the soil quantities of fertilizing material, both mineral and organic, to maintain the fertility that provides the means of life for all plants and animals and the means of economic prosperity for man, both in the country and in the city.

In addition to the five vivid panels mentioned earlier, the Hall also contains a relief map of the area made to scale, with farms, wood lots, and roads represented. One of the best touches is the use of a good modern automobile map of the area, which any citizen, through familiarity with such maps, can read and understand quickly and thoroughly. It is one of the modern touches and an extremely intelligent one.

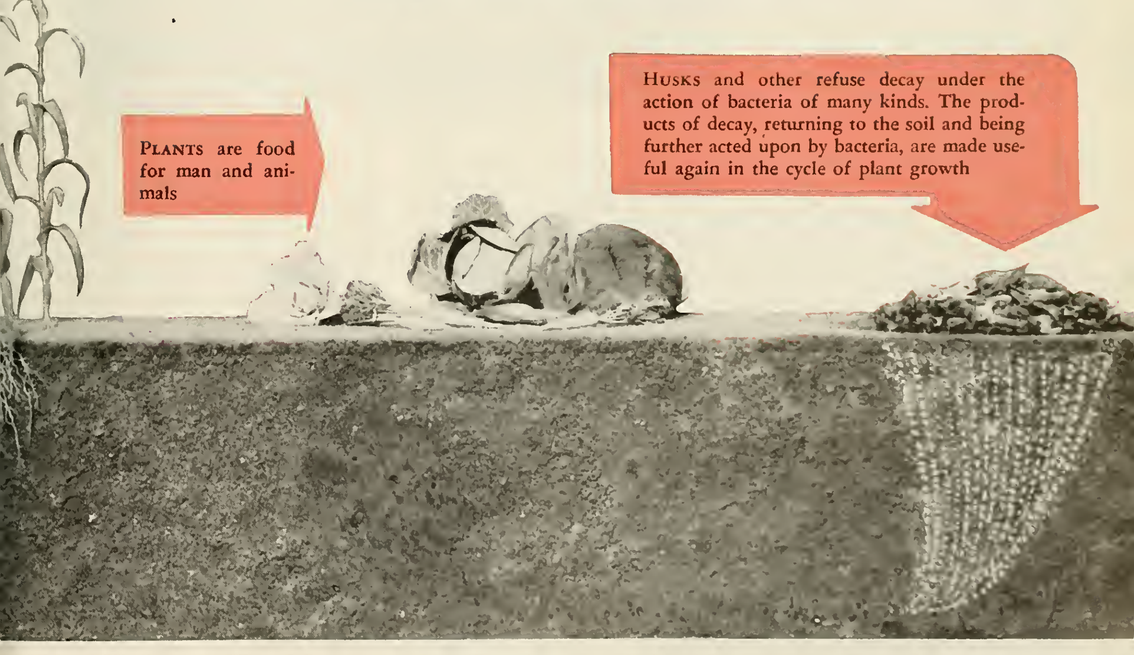
It is quite impossible within the limits of a single fairly brief article to cover all the exhibits in the new Hall, for they show with admirable clarity, detail, and simplicity the immense complexity and interrelationship of all living things. It is notable —and immensely so—that this is the first time that life, geology, paleontology, agriculture, entomology, and many other sciences have been represented in such a clear, comprehensive, and comprehensible fashion.

The exhibit showing the length of time involved in the formation of various layers of soils and rock is not only informative but fascinating to any mildly inquiring mind. You see the soil and the layers which represent, according to the circumstances, hundreds or thousands of years in their formation. Nothing, save perhaps the cross sections of the giant sequoias and redwoods in the adjoining forestry exhibit, can be so good for the superheated ego and reduce to the proper level of its essential insignificance the political nonsense of our times or the worries and preoccupations of the average man or woman.

There is an admirably clear chart and demonstration of the workings of photosynthesis and respiration, so far as we understand them, in the cycle of food, nutrition, and decay. Another similar exhibit deals with the workings of the legume family and its accompanying nitrogen-fixing bacteria in the renewal of the soil.

Here in the new Felix M. Warburg Hall one might almost say that the workings of the life principle are all set forth, that one comes very close to an understanding of why man and even life continues to exist and carry on despite frightful obstacles. The whole of the exhibit tends to produce a sense of awe, even of that religious feeling experienced by any true scientist with an uninhibited mind. But best of all, the new Hall puts all of the knowledge within the reach of the man in the street and the growing school child, in terms that are accurate, vivid, and interesting. Altogether the new Hall is a very great accomplishment and a very great step forward in museum technique and education. The public and the nation should be deeply grateful to the Warburg family and to Dr. Parr and his associates in this new accomplishment. It is truly a great show.

Some of the many other exhibits of the Hall will be presented individually in Natural History *from time to time*



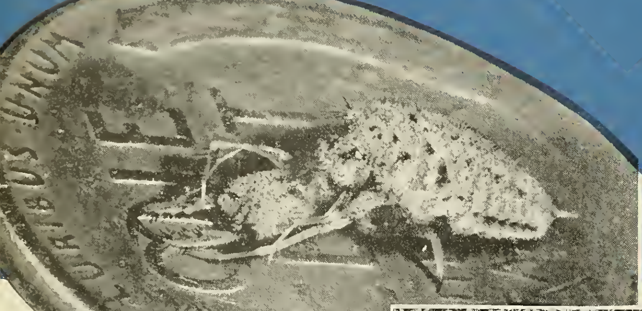
Plants are food for man and animals

Husks and other refuse decay under the action of bacteria of many kinds. The products of decay, returning to the soil and being further acted upon by bacteria, are made useful again in the cycle of plant growth

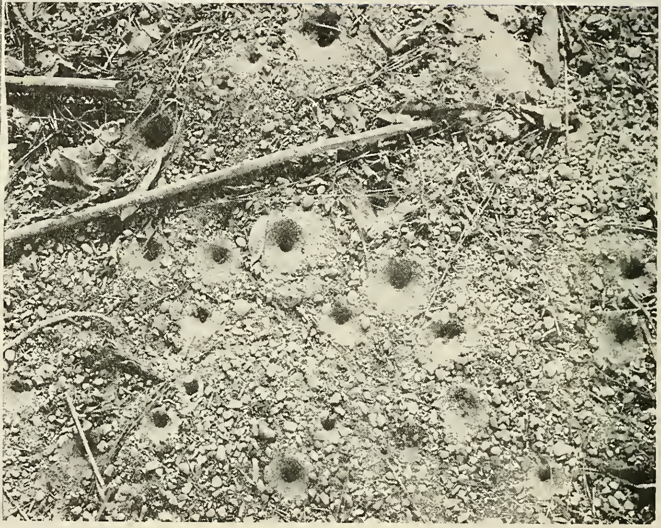
Patience Reward

The tiny funnel-shaped traps you have

but within their dark confines are



▲ THE STRANGE humpbacked creature that constructs this astonishing pitfall is equipped with jaws like hypodermic needles, which inject a powerful insect poison. The penny shows relative size



➤ IT IS NOT hard to find the pitfalls of the ant lion and to observe the insect at work. The ant lion normally lives in dry situations almost everywhere from your back yard to the Sahara Desert. The pitfalls are often found under ledges, eaves, etc.

IN nature there are many ways of making a living, just as there are with human beings, but some of the methods that animals have invented are far stranger than fiction. Take the case of the ant lion. Who would believe it possible that any creature could live and grow fat merely by excavating a pit in the sand and hiding in the bottom? Yet, this is the established way of life for the ant lion.

Almost everyone has seen the tiny pitfalls of these interesting creatures in dry sandy or dusty places, but few know much about the insects themselves.

In the first place, an ant lion has plenty of time. If it hadn't, its way of life would not work. It often has to wait a long time between meals, but it is well adapted to such vicissitudes.

To start at the beginning, the ant lion is a small insect approximately a third of an inch long, with six weak legs and a small head with two sickle-like jaws extending forward. One of the first things one notices about the ant lion is that it can walk only backward, and this is the mode of progression it employs in excavating its small pitfalls. When it has selected a site that seems to offer advantages from the standpoint of the ant lion, it begins to back through the sand and at the same time tosses the sand in the air by flipping its head upward. This process of backing into the sand until it is nearly covered and then tossing the sand out with its head continues in an ever-narrowing circle; and when the center is reached, a neat pit has been formed with nicely sloping sides.

Now, as often happens, the spot at which the ant lion chooses to dig may have a good many small pebbles mixed with the fine sand. This poses a problem to the pit digger but one that it can handle. The method that the ant lion uses to

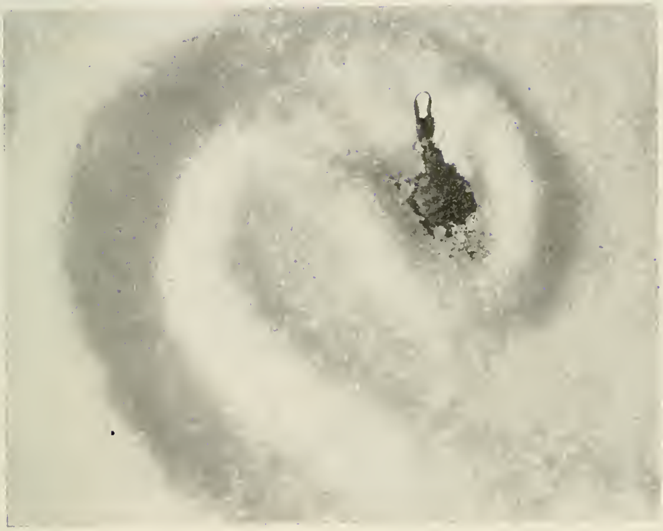
The Ant Lion

e dry sand may look innocent,

of the ant lion, ready to assassinate any luckless victim

By Ross E. Hutchins

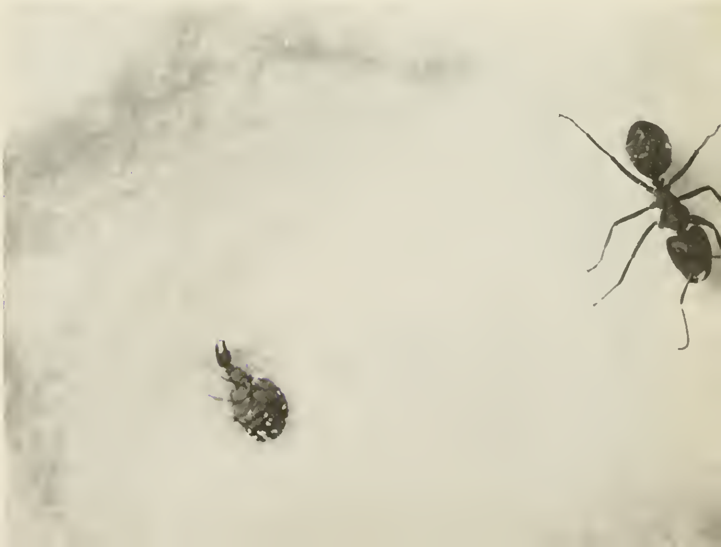
▲ The ant lion can easily be induced to dwell in a dish of sugar, where it is easier to observe the insect. Note the zigzag trail of one ant lion leading to an unfinished pit. Just beyond is a completed pitfall with an ant lion concealed at the bottom

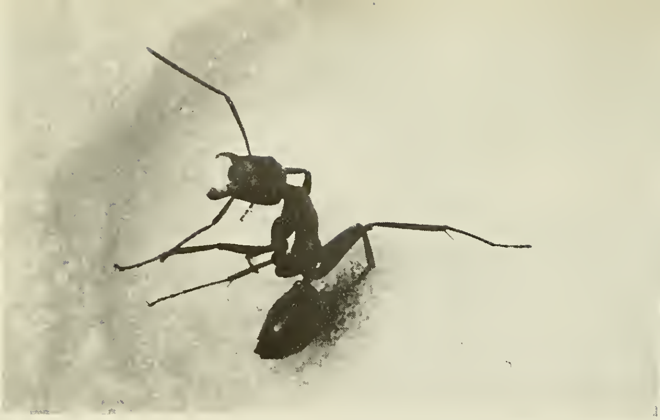


◀ The ant lion begins by making a circle and then continuing to work toward the center, tossing the sand out with its head and jaws. It then conceals itself at the bottom and waits for whatever fortune may bring. Ant lions have been known to live at the bottom of their pitfall for three years waiting for prey

▼ An ant comes near the edge. The soft sugar begins to give way, and the ant lion begins to toss particles into the air to knock the ant in

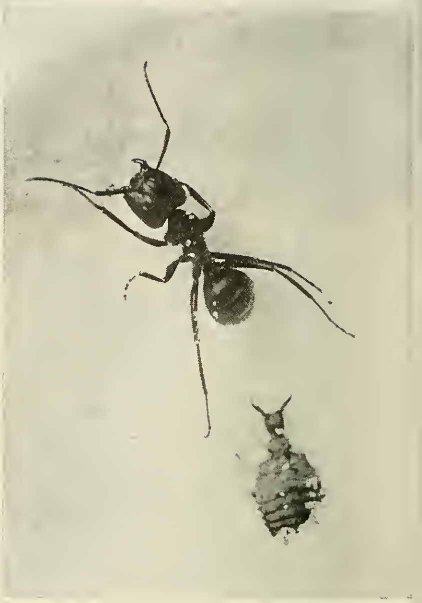
remove pebbles too large to be tossed out with its head was described by a French entomologist in the early 1800's but was questioned by later scientists until careful experiments were made in 1907 by H. C. McCook, whose observations follow: "Three pebbles, all larger and heavier than the ant lion, were dropped into the centre of a pit where they would be most inconvenient to the occupant and likely to prompt her to remove them. The ant lion thrust its head beneath a pebble and tried to toss it from the pit. Having failed in this, it tried another mode. It placed the end of its abdomen against and



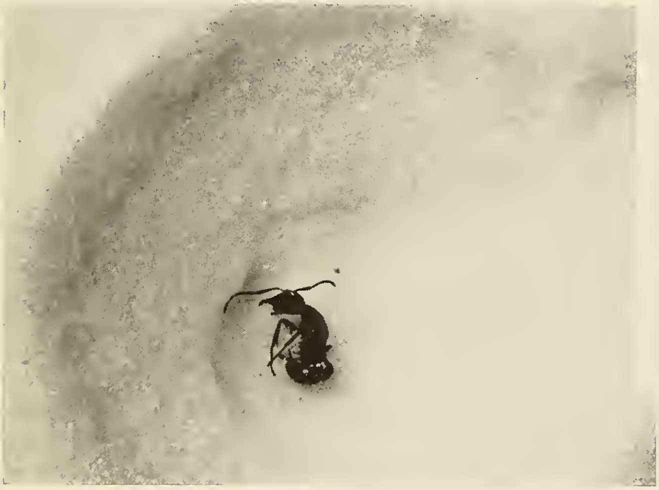


◂ The ant tumbles into the pit on top of the ant lion

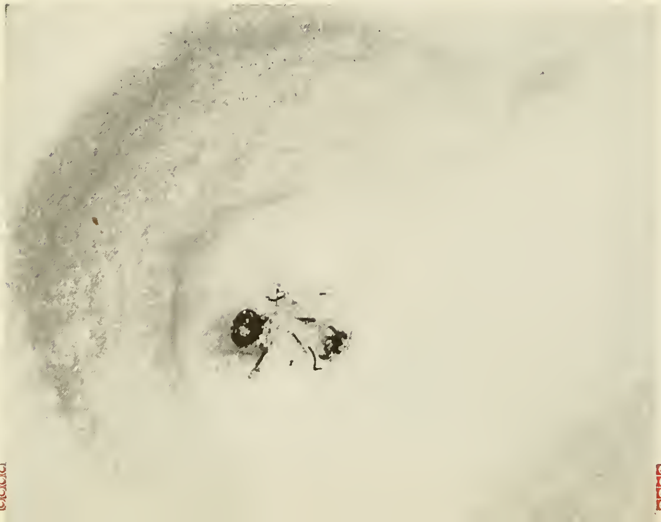
▾ The ant tries to scramble out, but the ant lion pursues it and . . .



▾ . . . drags the ant back into the bottom of the pit. The poison that the ant lion has injected into the ant has already taken effect



▾ The ant is being dragged beneath the "sand," where the voracious ant lion will digest it at leisure



a little beneath a pebble and began to push backward. A little time was taken to adjust the pebble so that its centre of gravity would be against the end of the body. Then the animal began to back up out of the pit. All of the three pebbles were thus removed." Thus, the correctness of the early observations was confirmed.

These pitfalls vary with the size of the occupant, but they probably average about two inches across and perhaps half that in depth. When completed, the pit is round with smooth sides; and the ant lion then takes up its position concealed in the sand at the bottom.

It waits.

An hour passes, a day passes, perhaps many days pass. Just how long the insect can wait is not known, but eventually its patient vigil pays off. An ant or other small creature wandering about accidentally falls into the pit. It tries desperately to climb out, but the shifting sand makes escape difficult. After a mad scramble, it seems almost on the verge of escape when the ant lion begins tossing sand into the air. With the falling sand overhead and the shifting sand below, the luckless creature suddenly finds itself tumbling to the bottom of the pit. Before it can recover its footing, it is seized by the sickle-like jaws of the ant lion. These jaws are really hypodermic needles, and within a few seconds the captive is killed by the injection of a powerful toxin.

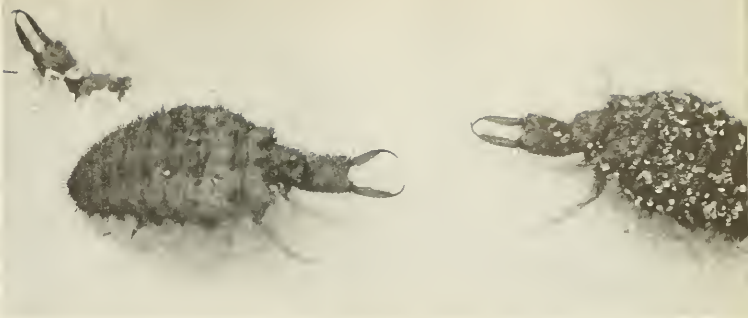
This toxin serves two purposes. In the first place it quickly kills the victim, and in the second place it has the remarkable power to digest or dissolve the body contents of the prey. Of course, this takes time but, as usual, the ant lion is in no hurry. It pulls its booty out of sight under the sand at the bottom of the pit and waits for the poison to do its work. After a time, it begins to suck the nutritious juices through the same hollow jaws into its own stomach, until all that remains of its erstwhile prey is a shriveled carcass, which it tosses out of the pit.

Among the other "believe it or not" characteristics of the ant lion is the fact that the intestinal canal is incomplete. In other words, this insect voids no excrement during the stage of its life that is spent in the pitfall. Another interesting thing is its ability to "play 'possum." If you pick one up with a pair of tweezers, it will usually appear to lose all signs of life, but when placed back on the ground, it will soon "come to life" again and go on about its business.

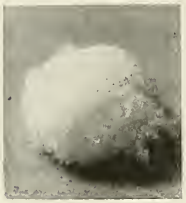
The life cycle of the ant lion is much longer than that of most insects, due to the intermittent nature of its food supply. It probably requires from two to three years to reach the adult stage. During this period many vicissitudes may overtake it, and it may move its pitfall many times. The ant lions shown in the accompanying photographs were collected in an area that is under floodwater to a depth of several feet each winter. Yet when the waters recede and warm weather returns, there are the tiny pits set up for business as usual. Truly, nature takes care of her children.

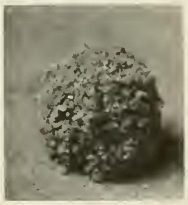
When, in spite of the irregularity of meals, the ant lion becomes a full-grown larva and is ready to transform to the winged form, it is faced with further complications. When the average caterpillar or other larva spins its cocoon, it

Continued on page 288

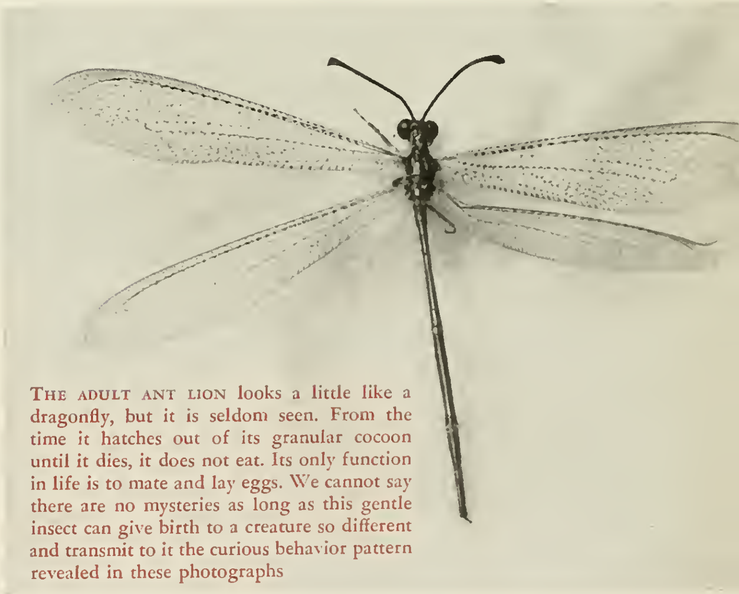


▲ When ant lion meets ant lion, only one is apt to leave the spot, for they are cannibalistic. The third individual in the background is backing into the "sand"





Cocoons of the ant lion. As astonishing as the skill of the ant lion in constructing its trap and capturing its prey is the fact that it transforms into a totally different looking creature. The cocoon on the left was constructed of sugar grains, while the one on the right was built of sand and in natural conditions. Out of these cocoons will come the gauzy-winged adult insect



The adult ant lion looks a little like a dragonfly, but it is seldom seen. From the time it hatches out of its granular cocoon until it dies, it does not eat. Its only function in life is to mate and lay eggs. We cannot say there are no mysteries as long as this gentle insect can give birth to a creature so different and transmit to it the curious behavior pattern revealed in these photographs

ON RIDGE TRAIL visitors can see a woodland typical of what early settlers found when they pushed through to open up the Old Nort

Forest Remnant

The early colonists found a new way of life in majestic groves like those in the Cook Forest State Park. In all the Northeastern States, few primeval tracts like this can still be seen

By HELEN FAYE

Photographs by the author

IN western Pennsylvania, a great steel-producing center and a remnant of primitive American wilderness stand almost side by side. Ninety-two miles north of Pittsburgh, great pines and hemlocks reach toward the sky in Cook Forest State Park. Cook Forest is one of the few remaining areas that bear a likeness to the Great Forest that once swept majestically across one-third of the Continent. Some of these very trees were approaching maturity when John Cabot sighted the green line of the western horizon in 1497. Today, this remnant of the old forest looks much as it did almost 1000 years ago when Leif Ericson came to Markland (Land of Forest) and is said to have returned to Iceland with beams of maple.

A chance remark led to our own discovery of this portion of ancient wilderness. We were showing photographs of the pine forests of California's Sierra Nevada to friends. One of them exclaimed, "Why, we have trees that look like that right, in Pennsylvania."

A little skeptically, we followed her directions to Cooksburg, a tiny village on a bend of the Clarion River. This river lies in a deeply dissected area near the western edge of the Alleghany Plateau. The Park headquarters is in Cooksburg, and at the doorstep of the ranger's office the dense stands of timber start their climb up the steep slopes of the hills to the top of the plateau. The Park covers 6000 acres, much of which has been untouched by man except for the building of trails. No serious fire has ever raged through these hills and ravines. The lumberman came close but spared the greatest trees.

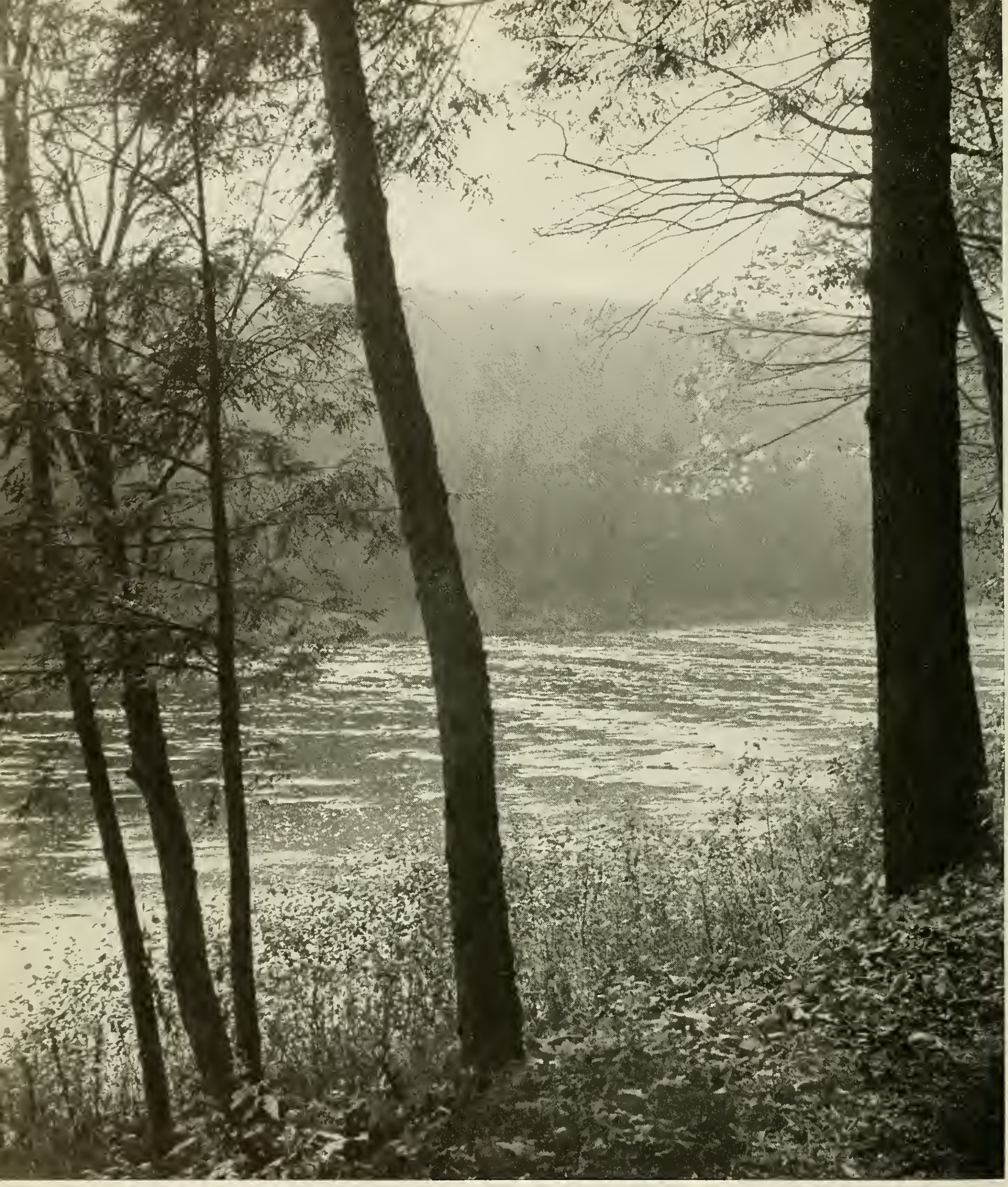
Our skepticism had vanished by the time we found our way to the Forest Cathedral (so marked on the Park map). Here, in a natural amphitheater in the hillside, we stood among pines that towered 200 feet above us. The sound of the wind in the branches, the patches of sunlight, the deeply fissured bark of the old trees—many of the sights, sounds, and scents of the Forest Cathedral were indeed reminiscent of the forests of our western mountains.

Perhaps as exciting as the beauty of this place was the knowledge that we stood gazing on the same America that this nation's forefathers had seen. In 1607, when Jamestown was founded, the Great Forest of conifers and hardwoods stretched from the Atlantic to the prairies beyond the Mississippi. Indian clearings and savannas broke the forest in a few places, but the green canopy of trees was the dominant feature of the land. There were places where tangled vines and underbrush grew as dense as a jungle; in others, the soaring trees had cut out the sun so effectively that the forest floor was as clear as a park. In Cook Forest we found just such an impenetrable woodland, as well as natural clearings where the intermingled leafy crowns kept the sunlight from filtering through.

The great migrations that colonized the New World brought settlers to whom the forest meant food, shelter, and a way of life. They cut wood to build and to heat their homes. They trapped and hunted in the forest for food and skins. They often set fire to the trees as a quick way of clearing the land, and if the fires got out of control and roared away over the mountain, it was serious, certainly, but not a disaster. There was more wood and more land beyond the horizon.

On the heels of the pioneer settler came the lumberman. As early

▼ TALL HEMLOCKS like these grow along a trail in Cook Forest Park—only 92 miles north of Pittsburgh



▲ **The Clarion River**, as seen from the River Drive in Cook Forest

as 1630, New Englanders exported forest products to their homeland. When the British Navy was cut off from its Baltic sources of supplies by the Dutch Wars of the seventeenth century, England looked to her American colonies for planking and resin, for turpentine, masts, and spars. In the Southern Colonies, the pine barrens provided tar and turpentine. In the Middle Colonies and New England, white pine provided the tall, strong masts on which the Royal Navy relied, even as our modern navies rely on oil for motive power. These mast trees of the Northern Colonies became so important to the growth and maintenance of the Royal Navy that special agents of the King were sent through the forests to mark all trees that were suitable for masts. This mark was a broad arrow, signifying that the tree was reserved for the Crown.

The early colonists, mostly British in origin, had grown independent of the homeland. Because of their own hard struggle to claim the fruits of the frontier, they felt that this appropriation of the trees was arbitrary and that it denied them their self-earned rights. In order to control the lumber industry and ensure ample supplies for the navy, the British home government passed a series of regulations culminating in the Timber Act of 1727, which severely restricted the cutting and sale of lumber except to Great Britain. The resentment of the mercantile colonists against this law (which if fully enforced would have crippled their export trade) and the backwoodsmen's indignation against the King's timber agents were high on the list of "tyrannies" that provoked the Declaration of Independence.

The eastern United States has since become a land of large urban and semiurban areas; of open farmlands and second-growth woods. Today an American looks almost in vain for a glimpse of the countryside the colonists knew. There are spots in steep ravines and on inaccessible slopes in the mountains of the East that the settlers and lumbermen passed by. But Pennsylvania's Cook Forest Park is probably the most accessible tract of virgin timberland in the densely populated northeastern United States. Buffalo, New York, is 147 miles away and Youngstown, Ohio, is only 88. New York City is a one day's drive to the east.

In the Forest Cathedral area, towering white pines and hemlocks sway above one's head. The trunks of huge trees lie rotting along the path, being reclaimed by the soil; and mosses, ferns, and mountain laurel cover the ground. Here we find the forest-grown Eastern White Pines, which resemble the famous mast trees of the British Navy. Each tree, forced by its neighbors to compete for the sunlight, has thrust its crown upward toward the sky. Their trunks are tall and wonderfully straight. They are not as large in diameter as those growing in more open places, and they lack the girth of the great trees of the West, but as one raises his eyes to their crowns, he can visualize these sturdy poles supporting white sails on all the seas of the world.

A good introduction to the Park is to hike along the Longfellow Trail, which leads to the big pines. Along the bottom land at the beginning of the trail, you pass through rhododendron thickets, bright with bloom in the spring. Tom's Run sparkles and races along here, and the ground is damp underfoot. The vegetation is luxuriant. Climbing the uphill trail, you hear a sighing, and above your head the pines are whispering in the wind. The mysterious faraway sound of the pine may actually be coming from trees only a few feet away, their fragile needles vibrating in the breeze. Ferns line the path; a tiny chipmunk darts away in alarm, and suddenly the forest is filled with sound. The drumming of a woodpecker is heard from faraway; a blue jay screams close at hand. A dramatic comedy unfolds before you: a red squirrel, chattering and scolding, is racing to the top of a thick beech, chasing

▲ THIS INTERESTING FORM is a hemlock snag that was probably struck by lightning

◄ A YELLOW BIRCH with multiple trunks. Cook Forest is an educational as well as a recreational region. Many large signs label the area you are passing through

▲ FOREST-GROWN Wild Black Cherry trees enhance the beauty of the area near the Ridge Camping Area

a brother along impossibly fragile twigs, flying through the air from branch to branch. Finally, having routed his opponent, he rests above your head and rasps his nagging chant of victory.

The scent of the pines, distilled by the sun and distributed by the breeze, floats down to you. A flash of color reveals a warbler darting through a patch of sunlight. At some moments these woods are alive with birds. You come to the upturned base of a fallen giant; pale green ferns are growing in the earth-laden roots; moss covers the rotting log. Farther along the trail you see motion, and a glossy-coated black squirrel pauses in alarm and then flees silently, avoiding each dead leaf, each twig that might reveal the route of his escape. Now, in the Forest Cathedral, you lie on your back with pine needles for a pillow and gaze up at the pine tops swaying in the wind. It is amazing to see the massive, sturdy tree beside you bend like a reed so far above your head.

Again following the path, you leave the stand of pure pines and hemlocks and find yourself walking among oaks and maples. The shining green leaves of mountain laurel contrast with lacy, young hemlock trees. In the distance, the silvery bark of a beech tree gleams in the dark forest.

To see a woodland typical of those the settlers pushed through in opening up the Old Northwest, you must visit the deep woods behind the Ridge Camping Area of the Park. The Camp Trail leads the visitor through primeval hardwoods: beech, oak, the silvery spires of blighted chestnuts, and a few virgin cherry trees, soaring over 100 feet, mingle with the ubiquitous hemlock. The dense thickets of fallen trees and underbrush in woods of this kind must have made hard going for men who hewed each path with an ax. You can almost hear the creak of their wagons, loaded with furs, freight, or household goods. This, too, is the place for one to see wildlife. A ruffed grouse may suddenly catapult from his hiding place to cross your path with wingbeats sounding like thunder.

Another primitive area of the forest is the Virgin Hemlock, a dense and swampy thicket with occasional natural clearings. If you find yourself following a narrow trail in this area, it will be one made by deer, for there are no man-made pathways here. The southern end of the Park is well traversed by 20 miles of footpaths, but there are also large areas without trails or roads, where the adventurous person may make his own way.

Cook Forest borders the Clarion River, which meanders in deep, lazy curves for seven miles along the Park boundary. The river road is an excellent place for a walk or drive after dark. We saw porcupine, opossum, skunk, raccoon, and a meadow full of browsing deer along this road at night. Cooksburg is located on the river, and in addition to the Park Office there are a grocery store, post office, gas stations, and several inns and cabin groups.

The State maintains housekeeping cabins and camp sites within the Park, and others near by are privately owned. There are bridle paths and a swimming pool but no neon-lit amusement places.

The Pennsylvania Department of Forests and Waters has made Cook Forest an educational as well as a recreational area. On the Lookout Road, leading to the summit of Seneca Ridge, your car passes through beautiful second-growth hardwoods. Along this road is the Demonstration Area, where large signs describe the kind of forest you are passing through. One of the most interesting is the Clover Field, which was a hayfield before 1900. Now fine young hardwood trees have seeded themselves here, and you may see how much woodland may be reclaimed by nature if left alone for 50 years. At the end of the Lookout Road is Seneca Point, where huge rocks jut out high above the river and valley below. Here is the Observation Tower, where a fire warden keeps watch and where you may climb above the treetops for a view of the whole forest and surrounding countryside. It is to the credit of both the Park officials and the conscientious public that there has been no serious fire in Cook Forest since it was acquired by the Commonwealth in 1927.

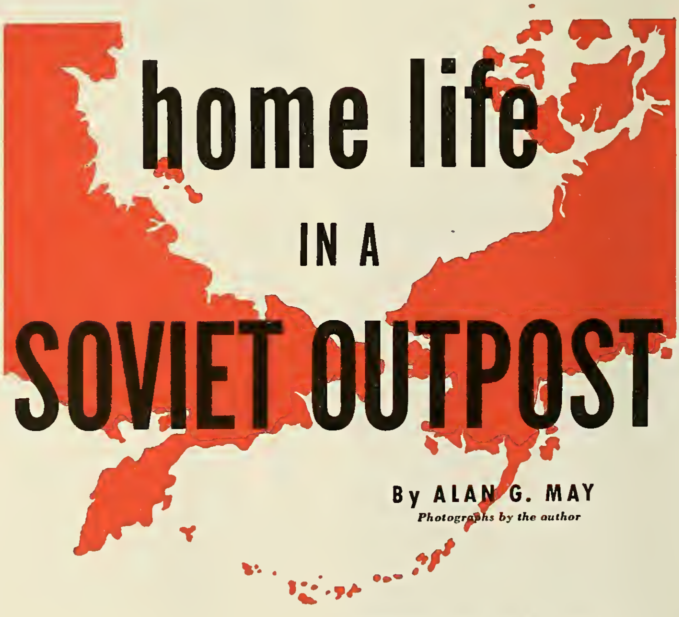
▲ EASTERN WHITE PINE, nearly 200 feet tall, resembling the mast trees used by the British Royal Navy before the Revolutionary War

One of the most interesting walks in the Park is along the Nature Trail. Many well-placed signs identify the trees and other plant life; sighting devices point out the nest of a crow and the holes made in a dead tree by the pileated woodpecker. Deer crossings, a porcupine den, claw marks on the trunk of a dead tree, a wild beehive, and many other interesting things are labeled for the visitor. Here, as you study nature, the hum of insect life, the small animal sounds, and the calls of the birds blend with the rustling trees to contribute to the murmur of the forest.

The same sun sets at almost the same moment on the blast furnaces of Pittsburgh as it does on the crowns of Cook Forest's tall pines. Modern industrial cities and densely populated areas encircle the Park. Yet here, watching the red glow fade to darkness in the complex pattern of foliage above, the roar of modern civilization is unheard and can fade momentarily out of our memories. This is the setting for a man in buckskin. This shadowy figure of our imagination carries a gun; he is seeking food for himself and his family from the abundance of the forest life. He pauses momentarily, his attention caught by a great tree. Perhaps he sees in its sturdy trunk a house to replace his rude cabin, a barn to house the animals he will someday have, fences to guard his crops against marauders, and a roaring fire for warmth and a good life. He sees these things in a flash of hope and then moves on.

▼ FUNGUS-FRUITING bodies growing on a dead hemlock snag

★ Delaying tactics seemed on the verge of frustrating this American scientific expedition, but dramatic, zero-hour permission to land on the Komandorskie Islands began a series of events few westerners today can hope to experience



home life IN A SOVIET OUTPOST

By ALAN G. MAY

Photographs by the author

MANY thousands of years ago, at the close of the last great Ice Age, peoples from Asia migrated to America by way of Bering Straits. Until recent times, however, there was some question as to whether or not the Aleutian Islands were used as "stepping stones" for additional migrations. Anthropologists maintain that the Aleutian chain was occupied from the Alaskan Peninsula, subsequent migrations having pushed farther and farther out, until the people eventually reached the westernmost island of Attu.

Beyond Attu, 190 miles to the west, lie the Commander or Komandorskie Islands. Geographically they are a part of the Aleutian chain, although they belong to the Union of Soviet Socialist Republics. Only 95 miles from the Kamchatka Peninsula, the islands come under the jurisdiction of the Autonomous Republic of Kamchatka.

Evidence found by expeditions working outward along the Aleutians sustained the theory that the islands had been occupied from the Alaskan mainland westward. But had there been any eastward migrations? The most obvious place to search for evidence of such a movement would be the Komandorskie group. As archaeolgical information concerning these islands was practically nonexistent, it would be necessary to make investigations on this Soviet territory before the question could be answered.

Unfortunately, the Soviet authorities did not appear to look on such a project with much favor. After considerable time, our Administration in Washington was able to obtain permission from the Government of the U.S.S.R. for the late Dr. Aleš Hrdlička of the Smithsonian Institution to take a party to the Komandorskie Islands for archaeological investigations. Arrangements for the visit in the summer of 1937 were supposedly completed before the expedition left the United States. Again, in 1938, Dr. Hrdlička applied for and received permission to take a group to the islands. The writer was a member of the expeditions on both occasions.

For reasons known only to the Soviets, delaying tactics, such as employed so often at the United Nations, were used by them on this occasion—*after* we had commenced the journey. Word received by our State Department from the Foreign Office in Moscow stated that the People's Commissariat for Foreign Affairs claimed that "a new situation had developed in the Komandorskie Islands"; consequently, permission to land could be communicated to the island authorities only after a delay of several days. This may be the reason why, when we arrived off the village of Nikolskoye on Bering Island, none of the officials had any knowledge of our coming.

The Komandorskie group is made up of two islands, Bering and Meydni (Copper), together with two or three small rocky islets. Bering is about 45 miles in length and 20 miles across at the northern or widest part. Meydni, 25 miles east of Bering, is long and narrow—30 miles in length but only 4 miles across at its widest point. The islands are mountainous with several peaks of between 2000 and 2200 feet. Near the village of Nikolskoye there is a large area of rolling country with many sand dunes. Like the Aleutians, the islands are desolate, dreary, and treeless. Earthquakes and severe storms are frequent. The climate, while harsh, is not severe. Waters

▲ The Soviet official Antipov *(left)*, second in command and Commissar of Police, and Dimitri Paliakov *(center)*, leading biologist of the islands, accompany the late Dr. Aleš Hrdlička on a tour. The expedition visitors had the freedom of the islands, with the exception of the barracks and the radio and meteorological buildings

▲ The village of Nikolskoye, with a population of 210. The people raise some vegetables, cattle, hogs, and blue foxes. There is only one store, which was reasonably well stocked with general merchandise

▲ Lieutenant Lazerof (white hat), chief Soviet authority in the islands, supervises the removal of fish from a fish trap. A gift of 50 large salmon was presented to the expedition party, who could repay only with the traditional American cigarettes

▲ Mr. and Mrs. Antipov, who opened their home to American guests. In the background is Lieutenant Lazerof

around the group do not freeze in the winter, although at times the ice piles up on the beaches when brought in by prevailing winds. During the winter there are heavy snowfalls, and some of the snow remains sometimes until the middle of August, which is the warmest month of the year.

Free copper is found on Meydni, as well as copper in combination with silver. Small deposits of iron and coal are found on Bering, together with dyeing clays of varying qualities.

Bering Island was first discovered by Captain Vitus Bering and his crew, when their ship, the "St. Peter," was thrown upon the shore during a violent storm, at a place now known as Komandor Bay. Bering, a Dane, had been commissioned by Peter the Great of Russia to discover whether or not Asia was connected with North America and also to establish contact with America. It was on the return journey of his second expedition, after Bering had sailed as far east as Kayak Island near Prince William Sound, that the "St. Peter" was wrecked on Bering Island on November 6, 1741.

The castaways, weak and ill from scurvy, were plagued almost beyond endurance by the innumer-

▲ ONCE THE RUSSIAN ORTHODOX CHURCH, this building was stripped of all religious insignia and converted into a Social Hall. To the right is the monument to Vitus Bering, discoverer of Bering Island

▲ NIKOLSKOYE VILLAGERS enjoy a rare interlude of sunshine. Clouded skies had concealed the sun for the past five months

able foxes. These animals had absolutely no fear of man. William Steller, the German naturalist attached to Bering's party, reported he killed over 70 foxes with an ax in one day—using the pelts to cover the roof of his makeshift hut. At the time, the island was uninhabited; the foxes had probably arrived on drift ice from Kamchatka. Thirty-two days after being wrecked, Vitus Bering died on the island. From the remains of the "St. Peter," the survivors, only 45 out of a crew of 77 men, built a small boat and set sail for Avatcha Bay on the mainland. On arrival, nine months after they were wrecked, they found they had been given up for lost. Their personal possessions had been appropriated by the inhabitants.

As guests aboard the United States Coast Guard Cutter "Tallapoosa," under the command of Captain N. G. Ricketts, we arrived off the village of Nikolskoye on Bering Island in mid-July, 1937, only to learn that we were not to be permitted to land. This was a bitter disappointment, for some of our party had traveled over 6000 miles to investigate these archaeologically unknown islands. Now it appeared we would have to return without even having set foot ashore.

Six Russians came aboard the "Tallapoosa" wearing a navy-type uniform; two of them were officers. The senior officer, we learned later, was a Lieutenant Lazerof of the Border Patrol. He was a small, non-smiling, intelligent-looking man. The other officer, named Antipov, was the second-in-command, and he also held the office of Commissar of Police. He was a friendly sort of person but had little to say in the presence of the Lieutenant. The two officers and the patrolmen were well turned out, especially considering that their post was so far from civilization.

Because of the language difficulty, the conference that was held developed into a lengthy discussion with, apparently, some misunderstanding on both sides. Dr. Hrdlička's Russian was a bit rusty, and he claimed the Russians spoke a dialect with which he was not too familiar. As the Russians claimed to understand some of the Aleutian language, the Doctor sent for Makari, an Aleut guide from Atka who was with us. It was hoped that Makari would be able to assist in interpretation. However, on seeing the Russian Lieutenant and his aide, Makari became so frightened he could hardly speak. All the Aleuts on the Komandorskies are descendants of those forcibly taken there by the Russians in the early 1880's. Some time later, when Makari had an opportunity to go ashore, he refused to do so, thinking he would be held there.

Lieutenant Lazerof was arrogant, truculent, and domineering. We had arrived, said he in effect, without permission and were therefore under his jurisdiction. He wanted to inspect the ship. He wanted to examine the arms in the armory. He wanted all cameras placed in the radio room before he sealed the door. He wanted to check off everyone aboard from the ship's roll call. In fact, it seemed as if he went out of his way to do all he could to antagonize the personnel of the ship. The situation would have been amusing had not time been so important to us. Finally, it was arranged that Lazerof would radio to Petropavlovsk for instructions, and we hoped this message would be relayed to Moscow. In the meantime, Captain Ricketts agreed to move out beyond the three-mile limit to await the reply, provided it arrived within a reasonable time. Unfortunately, through circumstances beyond our control, we could wait only two days. Permission would have to arrive before 7 P.M. on the second day or we would have to commence the return journey.

For two days we waited on a rolling sea; heavy rains, fogs, storms, and an occasional brief glimpse of

▲ **Kindergarten class** in session. The children, both Russian and Aleut, appeared in excellent health and were clean and well dressed—habits that are apparently encouraged in the educational program

▲ **Vitus Bering's grave**, on a lonely hill overlooking Komandor Bay, is marked with crosses erected long ago. On the beach below lies part of the keel of Bering's ship, the "St. Peter"

the sun helped break the monotony. When no word was received from the Soviet officials by 7 P.M., orders were given to weigh anchor. It was most discouraging. With the anchor half raised, there came a sudden shout: "Boat on the port bow, Sir!" Dramatically, at the very last moment, out of the fog and the rain, there came a small Russian boat, pitching and tossing wildly in the tempestuous seas.

Lazerof and Antipov came aboard to tell us that permission for our landing had been granted by the authorities. Apologies and regrets were expressed for the delay. They had been searching for the cutter for over five hours in the fog and rain. Honoring the arrival of the American ship, an official reception was to be given that evening in the village. Captain Ricketts, Dr. Hrdlička, and I were invited as the visiting American representatives.

Lazerof insisted that we go ashore in their small boat while the "Tallapoosa" followed under his guidance to a safe anchorage. This insistence was doubtless intended as a gesture of friendliness, but it proved unfortunate for us. The Russians manipulated their boat from a tiny cockpit in the stern, while the three of us had to cling to a small mast on a deck with no railings. The boat bucked and tossed, seas swept over it, and we were drenched. About 30 feet from shore, an anchor was dropped. Slowly backing away shoreward, the boat reached shallow water and the rudder was taken out. Proceeding a bit farther to shallower water, the propellor was raised on a universal joint. In this manner, the boat came to within eight or ten feet of the beach. A plank was thrown down, and we were able to walk ashore without stepping in the water; nevertheless, we were all cold and wet.

At the landing place—a shingle beach about a mile from the village—a lone blue fox crept up and sniffed at us. No one was in sight, but at a shout from Lazerof, there suddenly appeared from nowhere a group of children accompanied by a few older people. They gazed soberly at us from a distance, not replying to our greetings.

Following the graveled road toward the village, we came to the experimental fox farm and were invited in to see the animals. As it was almost dark by this time, little could be seen of the foxes. The buildings appeared to be well kept, neat, and clean, although there was a somewhat unpleasant odor.

Various buildings were pointed out to us as we passed through the village—the school, the barracks, and the social hall, which had previously been the church. All of the buildings were numbered and marked with the year of construction. The earliest date seen was 1880.

Lazerof led us into one of the larger houses, and we were introduced to several Russians and three Aleuts. Our host, we understood, was in charge of the radio and meteorological station. He had lived in Iceland for two years and at some time had picked up a few words of English. Now he was stationed here for three years while his wife and child were in Moscow. Dimitri Paliakov, the leading biologist of the islands, was a courteous gentleman who wanted to talk to us but was baffled by the language difficulty. Only one woman was present — a teacher of industrial work and animal husbandry. One of the Aleuts was the chief, while the others must have held some official position. Our conversation, if it could be called that, was long, arduous, and accompanied by much gesticulation. But with the help of the Doctor, we were sometimes able to make ourselves understood.

Raw fish was served after we had all been seated at a large table. This fish, we were proudly informed, was the famous Kamchatka herring. However, it was not very appetizing. Conversation lagged; the affair seemed stiff and formal. After providing everyone with a half-filled tumbler of vodka, one Russian rose and made a toast. The vodka, with which I was not familiar, tasted something like raw alcohol; so after taking a sip, I placed the remainder on the table. Lazerof, who was sitting next to me, dug me viciously in the ribs with his elbow, indicating with gestures that that was no way to drink a toast—it was a case of "bottoms up."

Quantities of food were brought in and passed around. A young reindeer and a suckling pig had been killed for the occasion, which was evidently regarded as a gala event. More toasts were given, but Dr. Hrdlička placed his hand over his glass when Antipov was about to refill it. Apparently the Doctor's refusal was accepted on account of his age. For Captain Ricketts and me it was a different matter, for the Russians would not accept a refusal from us. The Captain, a nondrinker, was on a spot, for to refuse to drink the toasts would have been an insult—or so we were given to understand. Toasts were given to America, to the U.S.S.R., to better relations between the two countries, to the Russian flyers, who that week had flown overhead on their way to America, to the Five Year Plan and others, in a seemingly endless series. Rising from the table, swaying slightly from side to side, one Russian patiently waited for everyone's attention. Holding his glass high, he said solemnly in English, "America, Good-by." Doubtless, these were the only English words he knew, so we drank to that, too, not wishing to tell him his English was a bit mixed.

In order to maintain the necessary prestige as the visiting American representatives, the Captain and I had to down drink for drink with the Russians. In all due modesty, I may say that we came through this ordeal better than did some of our hosts. One of them suddenly departed from the table and did not show up again until late afternoon of the following day. Another gradually slumped under the table. Toward the end of the meal, the last bottle of vodka on the island was ceremoniously placed on the table. Evidently containers were scarce, for the liquor arrived in a sulphuric acid bottle. Had it been acid, it is doubtful if anyone would have noticed the difference by then. The meal finished with piping hot tea into which was poured a teaspoonful of an unknown liquid from a perfume bottle, while American, Japanese, and Russian records were played on an old-type horn phonograph. It seemed odd to hear "Oh! Susanna" played on a Japanese record on a Russian island. Perhaps it was not so very strange that the Captain and I, walking back to the boat arm in arm for mutual assistance, found the road so much rougher than it had been a few hours earlier!

Left high and dry by the receding tide, the Russian boat lay on its side many feet from the water. Our hosts offered to put us up for the night. Returning to the village, Lieutenant Lazerof invited Captain Ricketts to stay at his house for the night, while the Commissar invited the Doctor and me to his home.

Mrs. Antipov was not in the least perturbed at being awakened in the early morning hours. She cheerfully found blankets for us while her husband was setting up two folding cots. This home, like others here, was spotlessly clean; it was evident that the Antipovs were fond of flowers, for geraniums, nasturtiums, and fuchsias were growing in window boxes.

Proud of his home, Antipov showed us some of his possessions in which he thought we might be interested. He showed us his small library and the local newspaper, *Aleutskaya Pravda*, which was published every six days. In a newspaper published in Petropavlovsk, he pointed out an article about the Aleutian Islands, written by the well-known botanist Dr. Isobel Hutchison, whom we had known at Dutch Harbor in 1936. The article had been taken from the London *Times*. From another room Antipov brought out his rifle and modern gas mask for our inspection. In order to entertain us further, he showed us some samples of free copper from Meydni, as well as many interesting photographs. Some of the latter showed sea otters, which were being raised in captivity at Gladskuvskaya Stanovische on Meydni Island. At that time, this was the only place in the world where these attractive animals were being bred for experimental purposes. Other photographs showed fur seals in large pens, for here the Soviets are raising seals in captivity for the first time in history.

The governmental authority of the islands was vested in Lieutenant Lazerof. The office of Director was held by a man named Ayleesh. As I understood it, Ayleesh was assistant to Lazerof, although Antipov was his senior in rank. Three Aleuts were members of the governing Council of seven persons. Protection and defense of the islands naturally came under the supervision of the Lieutenant and his "army" of about a dozen men.

Cabbages, potatoes, onions, parsley, and beets were seen growing in fenced lots the following day. Reindeer had been imported and appeared to thrive on the lush grasses. Fine-looking cattle were raised, as well as hogs and blue foxes. In many cases, foxes lived under the houses and were comparatively tame. We saw children playing with fox pups and fox pups playing with kittens. One fox was seen dragging a small rug from one of the houses. Hogs and foxes were unconfined and roamed the village at will, with the foxes acting as scavengers.

Possibly regulations prevented us from being invited into the barracks and radio and meteorological buildings, for these were the only buildings we were not free to enter. The radio station is situated on the hill behind the village. Climbing the hill with an idea of taking a photograph of the village from above, I was chased by one of the troopers, who indicated emphatically that I was to return to the village. Obviously visitors were not wanted near this building, for the trooper stayed at my heels till I rejoined the others down below.

A nurse was in charge of a small hospital and fortunately for us, she was able to speak some German. Compared to our city standards, the hospital would be considered very crude, but it appeared satisfactory in such an outpost of civilization.

We entered the school and were shown into the kindergarten. The children, both Russian and Aleut, appeared in excellent health and were clean and well dressed. Without doubt, we were expected. "Good morning! Good health to you!" they chanted in unison as we entered—in Russian, of course. Lazerof was very proud of the kindergarten and insisted I take some photographs. In another room, two women in white uniforms cared for tiny tots and infants, whose parents were out at work. There was an adequate kitchen where, we were told, hot meals were prepared for the youngsters. In the cloakroom were several washbasins with individual towels hung on pegs; the children's coats hung on the opposite wall. Cleanliness and health appeared to stand out prominently in the educational program. Without doubt, such instruction has proved beneficial, for during the two visits to the islands, we saw only one house that was not neat and clean.

◂ **Head man** at Glinka Gavan. The cap denotes his authority

▾ **A Red Flag flies** over the headquarters and home of Director Zykov at Preobrazhenskoe, the only village on Meydni Island. Here radio news is copied in longhand, put into pamphlet form, and passed from family to family

▾ **Residents** of Preobrazhenskoe dressed in their best clothes on the occasion of the expedition's visit

We were unable to purchase anything at the one and only store, as only Russian money was acceptable. The store was reasonably well stocked with general merchandise. Our hosts presented each of us with a chocolate bar from the stock on hand, and this compared favorably with American chocolate.

Because of the abolition of religion, the old Russian Orthodox Church, with all religious insignia removed, was now used as a social hall. Occasionally movies, dances, and amateur theatricals were held in this building. Reading material —newspapers, magazines, instructional and propaganda pamphlets, together with a fair-sized library (with books by such well-known authors as Tolstoy and Dostoyevsky being most noticeable)—occupied one room of the social hall.

Close to the hall was a monument of Vitus Bering. Embossed lettering on a metal plate paid homage to Bering. The anchor from the "St. Peter" lay to one side, and the whole was encircled by the anchor chain from Bering's ship and topped by a cross.

Near the center of the village, hanging from a wooden frame, was a beautiful bronze bell with decorative design in relief. It came from the church and is now used to call the people together for all important announcements. A very similar bell was in the church at Attu before the Japanese invasion.

Archaeological investigations were confined to the immediate area of the village, owing to lack of time for further exploration. No indications of an early settlement were observed, and no archaeological material was found. The locality of the village was a propitious place for an ancient site, for there was a stream for fresh water, a good beach for skin boats, and hills at the rear where lookouts could have been posted. Considerable erosion near the mouth of the stream could possibly have obliterated any old site that may have been there. A small area of the beach was littered with reindeer antlers and the bleached bones of seals, whales, sea lions, sea otters, reindeer, foxes, cattle, and hogs. Probably this place was the dumping ground after butchering.

When we arrived in early July the following year on the U.S.C.G. Cutter "Shoshone," under the command of Captain J. Trebes, we were greeted with great friendliness. Once again a reception party was held, this time in the home of Commissar Antipov. A vivacious redheaded young lady, Mrs. Chernofsky, wife of one of the schoolteachers, assisted in serving the meal. Again many toasts were given —too many but not as many as the previous year.

Before leaving in 1937, the ship's officers had given Antipov some Wenatchee apples. Now he very proudly called our attention to a small apple tree growing in a jar by his window. He had grown this small tree from the seed of the apples given him. It was the first apple tree ever grown on the Komandorskie Islands.

During the meal a Russian entered and, after obtaining permission from Lazerof, made a formal challenge to the men of the "Shoshone" to a handball game that afternoon. Naturally Captain Trebes accepted the challenge. The game was played in a friendly spirit with great excitement on the part of the onlooking inhabitants. The Russians won, but as one Coast Guardsman said afterward, "Well, no wonder they won. They played by one set of rules and we played by another!"

We had arrived on one of those infrequent sunny days, and we noticed that the school children had moved their desks outdoors into the sun. Later in the day while the sun was still shining, we saw one

▲ ALAN G. MAY and an Aleut at Staraya Gavan. Transportation throughout the islands, other than by water, is accomplished by dog team and sled even in summer over the grass

▼ A BORDER PATROL MAN poses with a young schoolteacher from Moscow

▲ SOVIET WHALING SHIPS in Preobrazhenskoe Bay. They had no whales alongside, although many had been seen offshore from Meydni of the teachers taking a group of children for a walk. This was the first time they had seen the sun for five months, and they were taking full advantage of it.

Director Ayleesh invited some of us to a dinner at his home that evening. Two suckling pigs were served, and it was during this meal that the following information was gathered:

The Soviet Government pays a pension to all nationals unable to work, regardless of age. A town started in 1935 on the Sea of Okhotsk had, by 1938, reached a population of 40,000 persons; in the vicinity of this city, over 400 miles of roads had been built. The Second Five Year Plan had been completed seven months ahead of schedule, and the Third Five Year Plan was then in operation. From a population of 210 people in Nikolskoye, 2700 rubles had been donated to the Armament Cause. Forty-three vessels reached Vladivostok by way of the Northeast Passage in 1936, although the previous year only sixteen were able to get through. This District was the first, in what the Soviets term the Far North, in which the whole population became literate.

Just how much of this information can be believed is, of course, questionable.

Later in the evening we were invited to a dance at the social hall. A phonograph was being used for music, but later one of the Russians played an accordion for the dancing. The dancing of the Aleuts was indeed both active and strenuous, the men wiping the perspiration from their faces on their sleeves, while the women used the collars of their dresses. In charge of the dance was a master of ceremonies, whose official capacity was indicated by a red band on his coat sleeve. Carefully he tried to explain to the Doctor just what was going on, so that the Doctor could, in turn, inform the visitors. The star turn of the evening was a Caucasian-type dance by Mr. and Mrs. Chernofsky, who could not have done better had they been professionals. They performed with great zest and abandon, apparently enjoying the dance even more than the spectators.

This time permission had been given for us to travel about the islands so that archaeological investigations might be made in likely places. Leaving Nikolskoye, we stopped first at Syevexnoe, where the fur seal rookery is directed by a young biologist. Conservation methods similar to those in use on the Pribilof Islands are in force here. Only the three-year-old males are killed for pelts. We were informed that this herd had been increased from between 2000 and 3000 up to approximately 50,000 animals.

Rounding the northern end of the island, we called at Sarana, a small settlement consisting of about a dozen Aleuts. One large storage building was full of dried fish tied in bales. Near by were several acres of fish drying on racks. In the river was a fish trap full of squirming fish. This trap was of exactly the same type as those built by the Aleuts of our own islands. It was suggested to Lazerof, who had accompanied us, that a few fish would be most acceptable to the ship's crew. At a word from the Lieutenant, some Aleuts ran down to the trap and returned with about 50 fine large salmon. We were only able to repay this generosity in an extremely small way—by giving the inhabitants cigarettes. It was noticeable that none of the Aleuts accepted the cigarettes without first looking for permission from Lazerof. He made no objections. Although the weather was not cold, almost all the Aleuts were wearing quilted jackets.

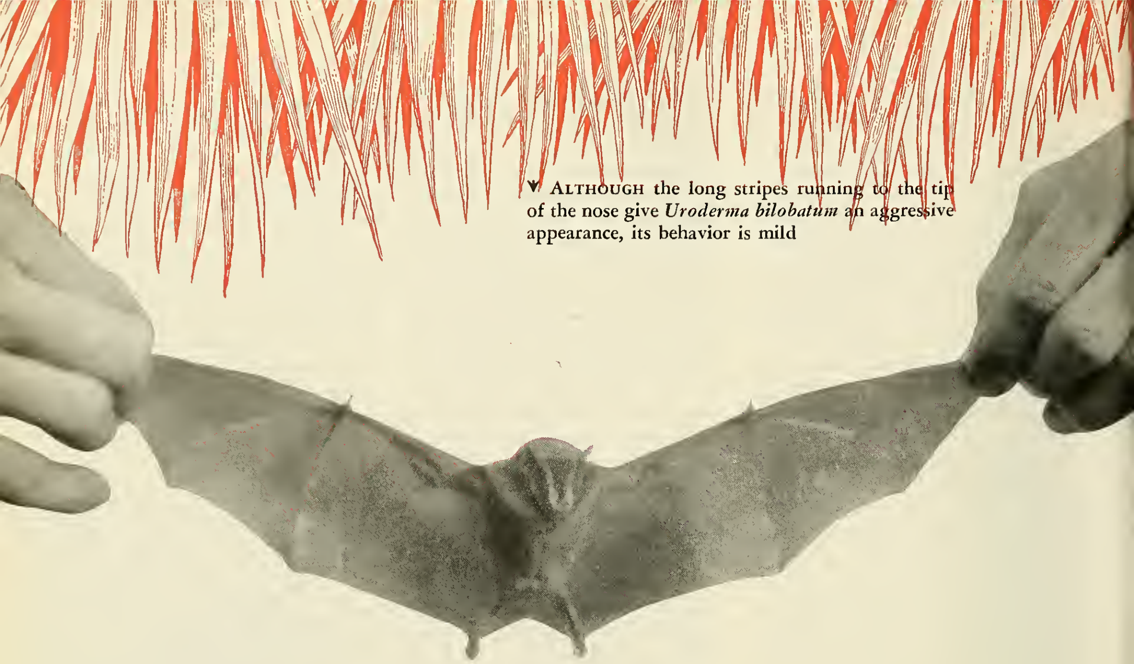
Transportation throughout the islands, other than by water, is accomplished by dog team and sled both in winter and summer. A special strongly constructed sled is used with efficiency over the tundra in the summer months. This sled is only about five feet long, with runners twice as wide as those used on snow. While excavating at Sarana, an Aleut arrived on one of these sleds with much yipping and shouting at his eleven-dog team. The sled dogs had been imported from Siberia, and many of them were quite vicious.

From Polovina Bay, where we made our next landing, we walked overland to Komandor Bay, the site of the wreck of the "St. Peter." Along the way, on a sandy beach, we came across hundreds of green Japanese glass balls used as fishnet floats. Above Komandor Bay, on a small knoll, we found Bering's grave. Originally it had been marked by a small mound of earth. Many years after Bering's death, the Russians had erected a small wooden cross at his grave. In time, this disintegrated at the base and fell. Then, in 1914, the crew of a Russian naval ship visited the bay and set up a larger wooden cross. This cross still stands on that lonely hill. On the beach we came across all that was left of the wrecked "St. Peter"—a large squared piece of lumber that had evidently been part of the keel. Big hand-forged square nails were extracted as souvenirs. Returning to the ship in the motor launch, we hit and slid over, without damage, an unseen reef—in all probability the very same reef on which the "St. Peter" came to grief in 1741.

Leaving Bering, we sailed over to Meydni, stopping at Shushkinskaya Buchta and Korabelni. Both of these settlements consisted of two or three houses and one or two families. The homes in these isolated places were spotlessly clean. Floors were well scrubbed, the brick stoves had recently been whitewashed, and in one home the copper tea kettle was bright and shining. No samovars were seen in the outlying settlements, although they were in use in the two villages. It is certain that this cleanliness and neat housekeeping was not done for our benefit, for these Aleuts were the most astonished people in the world when we arrived. It is more than likely that they had never seen such a beautiful vessel as the fine white Coast Guard Cutter anchored offshore.

We were well fooled by one Aleut at Glinka Gavan, who claimed to know where there were some old

Continued on page 285



▼ ALTHOUGH the long stripes running to the tip of the nose give *Uroderma bilobatum* an aggressive appearance, its behavior is mild

Bungalow-Building Bats

A series of snips with the teeth, and this winged engineer of the tropics converts a fan-shaped palm frond into a home that is snug and waterproof

By KENNETH W. VINTON

Photographs by the author

BATS are strange creatures at best, misunderstood by many people who still think the major sport of these flying mammals is to snarl themselves in one's hair. Bats are found in great variety and in many parts of the world, but some of the strangest members of this odd clan are to be seen in Panama. They vary from ugly broad-chested jungle bats, with a wingspread of nearly two feet and faces like gorillas, to fragile little mothlike creatures that scarcely look like a bat. There are fruit-eating bats, insect-eating bats, and the vampires of ill repute, which feed solely on fresh blood. Some have faces like bulldogs, others look like mice, while the most diabolical-appearing ones have the tip of the nose decorated with an erect spearlike growth that resembles a leaf.

In spite of the variety of forms, habits, and characteristics of the Panama bats, all of them seem to agree that the most desirable place to live is in the dark. In settled areas, the dark corners in deserted buildings, attics, and old belfries will usually yield their quota of these nocturnal creatures, while natural caves are always a standard habitat for countless other thousands. Those living in the jungle find shelter in hollow logs and hollow trees; and even a temporary house like an old empty bees' nest is never overlooked. Many hide in the deep shadows of matted vines; others commonly use the drooping fronds and broad leaves as shelter.

However, in this diverse nocturnal clan there is one stripe-nosed bat, *Uroderma bilobatum,* that is not content to take "pot luck," but like a good engineer, it builds its own bungalow of palm fronds. Another bat in Panama, *Artibens watsoni,* has been reported to have similar habits. The accompanying photographs show the simple but effective technique that *U. bilobatum* uses in converting a fan-type palm frond into a snug house. As though guided by the calculating eye of a mathematician, the bat cuts the midribs of a leaflet in a circular course around the base of the fan. The frond then collapses to make a cylindrical enclosure of drooping leaflets.

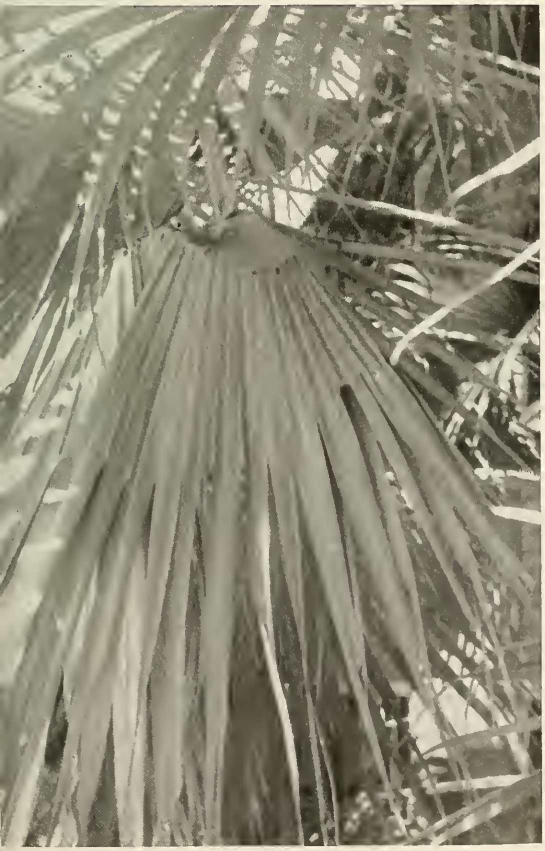
These little architects practice

their art on a variety of palm trees. The chief requirement seems to be that they have a fan-type frond. However, the bats are sometimes misled by the shape of the frond, for occasionally they fail rather badly when they attempt to collapse the solid fronds of the imported Chinese fan palms.

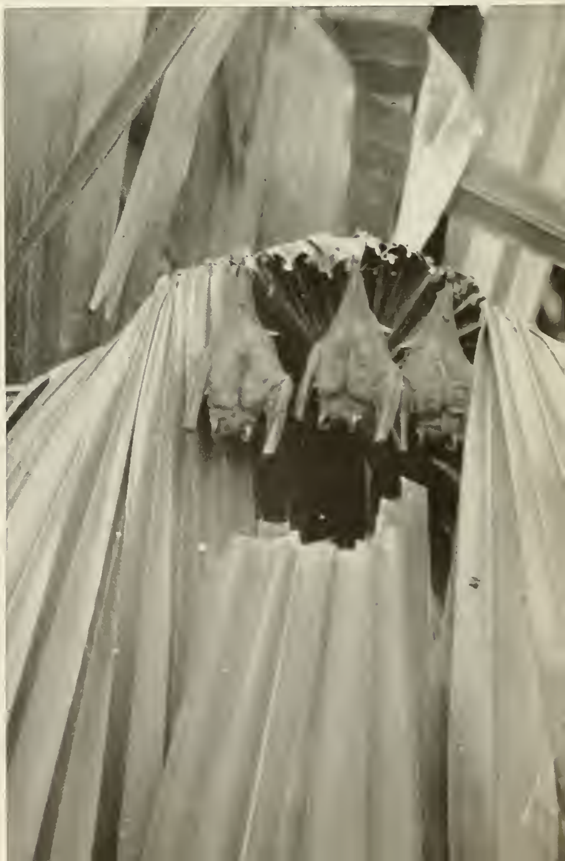
A little outdoor observation in the cities of Balboa, Ancon, or Panama City will reward the seeker with an interesting view of the drooping bat-built bungalows. These palm frond houses are dark inside and waterproof; and since the only entrance is through the small space below, they are very secure from potential enemies. In building the house, when the bats chew the supporting ribs, they rarely sever them completely. The collapsed portion still draws nourishment from the tree and often stays green from six to eight months.

How these little bats happened to start building houses of palm fronds is a mystery. The urge that starts them working on a new house is unknown. Many fronds seem to be collapsed, then left unused. The possibility that a palm tree with a desirable type of frond stimulates the little engineers to build more houses than they need has never been investigated. The question whether these flying engineers have modified their technique to meet the problems involved in converting the fronds of imported palm trees into houses remains unanswered. In short, we know very little about the reasons why this bat builds its house as it does. But basing our decision on how he does the job, it is surely not an overstatement to call him the engineer of the bat world.

▼ THE BAT cuts the midribs of a large frond, and the leaflets fall nto a vertical position. Note the circular line of the cutting, which gives the collapsed fan a cylindrical shape



▼ THE BATS are so timid that the author was forced to resort to trickery to show them hanging in their home. They were captured in a butterfly net, etherized until they were too groggy to fly, and then hung in the opening of their cutaway house for a quick photograph



OPERATION *Snailfolk*

By
R. Tucker Abbott
Division of Mollusks,
United States National Museum

In one of man's strangest experiments, a slow-motion David and Goliath are at this moment locked in battle on a tiny Pacific island. The outcome will influence the future of agriculture in certain parts of the world

GOLIATH, the giant African snail, is the six-inch-long, plant-eating dilemma of agriculturists in the Pacific Islands. In little less than 100 years, this hungry pest has spread from Africa eastward across the tropical areas of Asia and the East Indies and northward to our Trust Territory and the Hawaiian Islands.[*] Anxious agricultural quarantine officers in the Americas have intercepted Goliath on incoming ships at least seven times in the last three years. An act is now before Congress in which a fine of $500 and a one-year jail sentence await any person bringing the giant snail into the United States.

Because of his ability to establish himself quickly in new areas and the speed with which he reproduces, Goliath has caused man to employ every means at hand to rid the islands of this molluscan monster. Poison baits, hand-picking, protective ditches, live steam, flame throwers, and cyanide gas have all been tried with varying degrees of success. Although commercially grown crops are now for the most part considered sufficiently protected, Goliath continues to flourish in the hills and often raids small flower and vegetable plots. His continued presence in the islands presents a constant threat to areas not yet invaded.

At last comes hope from an unusual quarter—from Goliath's homeland and from among his former jungle associates. David, the African *Gonaxis,* is a small, thimble-sized snail with a voracious appetite for other snails. At this moment, Goliath and David are locked in battle on a tiny, remote island in the western Pacific in one of the most unusual biological control experiments ever attempted. The recent introduction of David to the experimental island of Agiguan (or Aguijan) in the Marianas Islands is one of several projects that have been undertaken by the Pacific Science Board of the National Research Council to reduce the effectiveness of destructive Goliath.[†]

"Operation Snailfolk" began in 1949 when Dr. Francis X. Williams was sent to British East Africa to search for a natural enemy of the giant African snail (*Achatina fulica* Bowdich). An intensive study was made along the coasts of Kenya Colony, Tanganyika Territory, and Zanzibar. Dr. Williams' search finally ended in a small bit of jungle south of Mombasa, Kenya Colony, where he discovered the presence of David, more familiarly known to scientists as *Gonaxis kibweziensis* (E. A. Smith). In Dr. Williams' opinion, David had all the qualifications for slaying Goliath – a healthy appetite, a weakness for giant African snail meat, and, unlike other predators of *Achatina,* such as the mongoose, baboons, and rats, a meek and retiring disposition.

It was a year later that I was called on to follow in Williams' footsteps and collect enough live Davids for the biological control experiment on Agiguan. My flight to Africa and thence around the world via the Marianas Islands was to be another chapter in the unusual story of "Operation Snailfolk." On a chilly

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[*] See Dr. Abbott's articles "March of the Giant African Snail," NATURAL HISTORY, February, 1949, and "Snail Invaders," NATURAL HISTORY, February, 1950. —ED.

[†] These studies were aided by a contract between the Office of Naval Research, Department of the Navy, and the National Academy of Sciences.

AMNH photo

➤ **David and Goliath.** David's healthy appetite and his weakness for giant African snail meat may profoundly affect agricultural output

⮟ **The Odyssey** to control a certain snail on the opposite side of the world began in a museum office in Washington, D. C. The big, crop-eating *Achatina* had spread at an alarming rate; but reports from Africa hinted that the little *Gonaxis* might be more than a match for it

Courtesy of James Nevin Miller

April morning I passed by the cherry blossoms on the way to the Washington airport, and in less than two dozen hours I was watching at night through the plane windows the flashing of lightning of the great storms that guard the upper reaches of the Nile. At dawn, the blue-gray shores of Lake Victoria could be seen on the hazy horizon, and by noon the plane had settled her wheels on the modern airport at Nairobi, capital of Kenya Colony. I could not help but feel, despite the marvel of modern air transportation, that this had been a shallow experience in comparison to the months of toil endured by men like Livingstone and Stanley to gain half this distance.

By May 1, I was settled in a small *banda* (thatch-roofed hut) at Diani Beach, which borders the Indian Ocean some 20 miles south of the port of Mombasa. "Enlightened and modern" Africa soon meant hot days of endless rain on the coast, struggles on washed-out roads, dreary work alone at night by the light of a kerosene lamp, and daily tramps into the thick bush in search of snails. One of the operational necessities of this phase of the project was to strike quickly—to collect as many Davids as possible in the shortest time. Intelligence reports from Williams and other snail scientists indicated that successful hunting could only be done during the few short, rainy weeks of spring. I was pioneering in capturing large quantities of this relatively uncommon species. In addition, the problems of shipping sensitive live snails were yet to be met.

The rainy season was now two weeks old, and the forest behind my *banda* had already been transformed from its brown, dry sleep of months of drought to a refreshing, ever-expanding world of living green. There was little difficulty in finding specimens of the giant snail.

On wet days like these, every living Goliath was lumbering about in full view, foraging for food. In certain areas, empty Goliath shells were scattered about the jungle floor like so many bleached bones—mute evidence of the effectiveness of his natural enemies and the mysterious hazards of life in the African wilds. For the better half of the first day, I searched in vain among the clumps of grass, under fallen leaves, and in the soft wet earth for elusive David. Occasionally I would find his empty shell. At long last I discovered my first living specimen nestled against a half-buried Goliath about two inches under the soil. I realized then that David was most apt to be found in the vicinity of a Goliath who was either in a state of quiescence or in the act of laying eggs. But even armed with this knowledge, I was unable to find more than a dozen living specimens on the first day.

That evening in my *banda*, by the light of a kerosene lamp, I examined my tiny captives. David carries about with him one of the strangest of snail shells. Unlike most shelled land snails of the woods and gardens, whose whorls are evenly coiled with a gentle, geometric increase in size, David has grown on a kilter. He has the appearance of having been squashed obliquely to one side. The body, foot, and delicate tentacles are colored a beautiful yellow-orange. When withdrawn into the shell, they give the translucent, amber-colored whorls a delicate pinkish tint.

When David is hungry, he can sense the presence of a near-by Goliath by means of his olfactory organs, located in the tentacles. David has no special method of attack, no secret weapon. He simply glides or burrows toward the inviting odor and, upon reaching a wall of *Achatina* meat, begins to gnaw and scrape off bits of flesh. The lumbering Goliath rarely, if ever, attempts to escape. His only defense is to withdraw into his own shell and secrete a token blanket of mucus. The farther Goliath withdraws, the closer the attacker moves in, and because David is so small, he can follow into the aperture of the big shell and literally eat his victim alive.

▼ ONE of the thatch-roofed *bandas* at Diani Beach, Kenya Colony, where the author accidentally discovered the secret of putting his voracious snails to sleep for shipment to an islet in the Pacific

R. Tucker Abbott photo

I realized that I should be collecting far more than a dozen Davids a day. I needed over 1000 healthy specimens, and, if the mission stretched out over a period of a month, I had no assurance that the snails collected on the first few days would remain alive in captivity for any great length of time. Attempts to lure David by crushing giant snails and setting them out at night in little piles on the forest floor were unsuccessful. An ant collector would have proclaimed the experiment a roaring success.

R. Tucker Abbott photos

▲ David, the African *Gonaxis*

Then I put a bounty on David's head—a price that would assure the undivided attention of the local natives. For a week, a minimum of land-clearing and stone-hauling was done in the area, but the Davids began to turn up in encouraging numbers. In the late afternoon, the natives would line up outside the *banda* where the strange *Bwana* sat and paid ten Kenya cents (two cents U. S.) for each *doo-doo*. On the second evening, I ran out of small change as my collection of Davids reached the 300 mark. I began to issue I.O.U.'s and sent into Mombasa for a large sack of coins. Within 10 days I had an ample supply—2000 healthy specimens—so I allowed the price per snail to slide and finally let the bottom of the market fall out. Stone-hauling became more profitable, the "deucedly queer" practice of gathering snails ceased, and the local Indian shopkeeper sold more cigarettes in the next month than he had in a year. Everyone was happy.

My joy, however, was short-lived. I was not prepared to handle 2000 active, cannibalistic snails. Extremely humid weather was a great asset in collecting snails, but it made preparation for shipping exasperatingly difficult. When I placed 50 or more snails together in a box, they became ensnarled in a slimy, squirming ball. The specimens at the center were endangered by lack of oxygen, and I suspected that a certain amount of cannibalism would be practiced. Loosely wrapping an active snail in a small piece of dry paper was of little use, for the moisture from the mollusk's body would wet and weaken the paper and allow the snail to escape. The entire success of the mission

▼ David, maneuvering into position to attack and kill lumbering Goliath, the giant African snail

➤ TINY, isolated Agiguan Island in the Marianas, where the battle of the snails is on. Can little David rid the Pacific islands of the destructive giant African snail?

R. Tucker Abbott photo

hinged on my ability to dry the snails without killing them. Outside the *banda,* the night rain gently but persistently reminded me of the remarkable relative humidity. Inside, the cement floor was beaded with moisture, and the mosquito netting over my bed sagged in a clammy mass. When I finally went to bed, the sheets felt like two giant slabs of cold bologna and kept me awake long enough to plan the morrow's action.

The next morning I divided my catch into 20 groups and began sacrificing them in groups of 100 in various experiments to enforce estivation—a type of summer sleep induced by dry weather and lack of food and water. I turned an old-fashioned, wooden clothes hamper into an incubator-type drier by placing two kerosene lamps inside and leaving the door ajar for ventilation. Within three hours, the first hundred had withdrawn into their shells. I then loosely wrapped each David individually in a sheet of dry tissue paper. I worked into the wee hours of the morning and managed to wrap 500 before I fell asleep.

In the tropics, it does not take long to discover whether a snail is dead or alive. The warm climate, with the help of bacteria, brings on putrefaction in a few hours. The odor of a recently dead snail is at first extremely faint—a mere whiff of clam broth, not at all unpleasant. In a few hours, this is replaced by an oversweet, cloying perfume, which is still not particularly offensive. But the next stages are what one might expect, and no description can match the offense. Oddly enough, when decomposition has long ceased and the dead meat has become dried for several months, a new odor comes on which is very similar to concentrated bouillon cubes.

The day following the drying experiment, I began to smell clam broth; by evening, I could smell ripe snails. I unwrapped each of the tissue packages, tested with my nose 500 times, and separated the survivors—a dozen uneasy Davids.

I found the sun was putting in an appearance for an hour or so each midmorning, so the next day I placed 50 snails in a tray out in the open. The effects were as disastrous. After sacrificing 200 more specimens, I discovered that an exposure of more than 15 minutes of direct sunlight was fatal and that anything less would not induce estivation.

It was quite by accident and in a mood of resignation that I discovered a simple and quite unscientific way to make David sleep. I went to bed one evening, at a time apparently when the humidity was not unusually high, and let my snails roam at large about the *banda.* All night, they crawled in every direction. In the morning half of them had withdrawn into their shells, and the remainder were barely moving. The continuous loss of moisture in crawling over the relatively dry tables and walls was enough to convince David he should pull into his shell and wait for a more rainy day. A crawling snail lays down a carpet of moist mucus, and its foot actually glides over this film, not on the ground itself. This is the silvery trail you see left by snails on garden paths. It prevents dry dust and sand particles from adhering to the snail's foot and also protects the body from discomforting acids of the soil.

I was able to continue this technique when I returned to Mombasa the following week. The third floor of a modern hotel offered one of the driest rooms in town, and in three days of peanut-hunting for David, and with endless hours of unwrapping, sniffing, and wrapping, I was able to prepare my boxes for final air travel to the Pacific. To this day, I do not know if the hotel manager has been able to find an explanation for the silvery tracks on the floor, walls, and furniture of my room or to explain my extravagant use of rolls of tissue paper.

I did not accompany the first contingent of about 400 carnivorous snails to the Pacific. They were sent off by air express on a route that winged them over Egypt, Pakistan, India, Hong Kong, and finally the Marianas. In ten days, David spanned a distance that had taken Goliath nearly a hundred years to cover at a more than normal snail's pace. My share in "Operation Snailfolk" was for the most part complete, except for a later flight to the Marianas and arrangements for future shipments. I proceeded to Tanganyika and Zanzibar to carry out more snail investigations and to collect living *Scolia* wasps in connection with control measures against the destructive coconut beetle in the Pacific islands. In the meantime, the shipment of Davids was met at the Guam airport by Mr. Robert P. Owen, Staff Quarantine Officer at the Trust Territory Headquarters, who had been chosen to make the trip to Agiguan Island. The last phases of David's long and unusual journey was made by motor launch and rubber life raft.

Tiny, two and a half mile long Agiguan island sits like a giant aircraft carrier at anchor near the southern end of the long necklace of islands in the Marianas Archipelago. On an extremely clear day, Agiguan can be barely discerned from the heights of Guam Island, which lies some 74 miles to the south. From Saipan and Tinian, it is plainly visible to the southwest across a narrow stretch of water. Agiguan is elongate in shape and oddly terraced by eight steplike cliffs. The highest terrace is relatively flat and gives the illusion of a gigantic flight deck. On a rough day, the Pacific Ocean rings the cliff-bound island with a wreath of heavy, white breakers. There are no beaches on which landings can be made. During the Japanese occupancy after 1936, the only approach was at the southwestern end, where a giant straw basket was drawn up and down on a wire stretched from the top of the cliff to an anchor on the sea bottom. Later, rock stairs were built on the side of the cliff; but even now, approach must be made on a calm day.

On May 31, 1950, three weeks after their departure from East Africa, the *Gonaxis* snails were planted on Agiguan by Mr. Owen. The results of the experiment will not be known for many months, perhaps even years. David's first hurdle is to acclimate himself to his new environment. Should David's adopted island prove kindly and allow the increase of his kind, Goliath, the giant African snail, will be on the defensive for the first time since his invasion of the Pacific. The outcome of this battle between snails is dependent upon so many variable biological factors that placing bets at this time would be extremely risky. For the present, rockbound, isolated Agiguan guards the outcome of one of man's strangest experiments with nature.

HOME LIFE IN A SOVIET OUTPOST

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burials. The place was several miles away, but he would be glad to show us if we would go in the launch. Following the Aleut's directions, we landed at Peresheek, where there was one house and some fox pens but no one there at the time. Having arrived at his destination, our guide now vaguely waved his hand in a semicircle and had no further interest in the matter. It was not a very likely location, and a thorough search convinced us this had been a false lead. Our Aleut friend had subtly obtained what he wanted—a ride in the motor launch!

Preobrazhenskoe is the only village on Meydni; and when we arrived offshore, the fog was so thick the village could not be seen. Fortunately, the fog lifted about dusk, and we were able to land. Director Zykov, an Aleut, was in charge of the village. He was an outstanding man on account of his size—without doubt the largest Aleut seen on the islands.

We were Zykov's guests for dinner at his home in a large room with a twelve-foot ceiling and a huge brick stove covering one end wall. Questioning the two oldest Aleuts on the island after dinner, it was found they knew nothing of any old sites and had never seen any artifacts. Both of these men had been born on Meydni and had never left it, not even to go to Bering. Zykov ordered some sea otter pelts brought in for our inspection. These beautiful and valuable pelts received no more care and attention than did common fox pelts.

Here, as at Nikolskoye, there is an electric-light plant, but during the summer months the plant at Preobrazhenskoe is shut down in order to conserve fuel. The fine-looking church had been boarded up and was not in use. Radio news was copied down in longhand, put into pamphlet form, and passed from family to family. After having made the rounds, the pamphlet was filed away by the Director. The news is 36 hours old when received.

Three Soviet whaling ships dropped anchor in the unprotected bay just before we left the next morning. They had no whales alongside, although we had seen many of them offshore from Meydni. We photographed these Soviet ships as we sailed close by on our departure, and one did not have to understand the Russian language to know that the crews were heaping vituperation on us for so doing.

Gladskuvskaya Stanovische is a small settlement of less than a dozen persons and is the location of the Sea Otter Experimental Station, under the direction of a biologist. This young man was keenly interested in his work and had, when occasion demanded, performed Caesarean operations on some of the animals. The laboratory was the only log building seen in the islands. Foxes, hogs, and cattle roamed around the buildings, and one exceptionally fine bull was staked out near some fox pens. The sea otter pens are built in a saltwater lake in which the tide rises and falls. One pen had been built in a fresh-water creek in order to determine if these animals can live indefinitely in fresh water. It would seem from the work being done here that the Soviets may possibly be recreating a profitable fur industry.

Returning to Preobrazhenskoe, we said good-by to Lieutenant Lazerof, for he was staying here until such time as he could return to Nikolskoye on a Russian boat. Lazerof had been of great assistance to us. In spite of the insufferable arrogance he displayed on coming aboard in 1937, his later actions proved he could be agreeable when he wished.

Archaeologically, our investigations had been negative. They did not indicate that the islands had been inhabited before the coming of the Russians. We had examined all the likely areas in the vicinity of our landings. Excavations were made at several of these places, but nothing pre-Russian was unearthed. In no case had the debris from any site accumulated to a depth of a foot.

However, the investigation of twelve small areas in seven days on two different islands appears to the writer to be inadequate for a definite determination as to the possibility of a pre-Russian occupation. Considering the fact that the mainland of Kamchatka can be easily seen from Bering in good weather and that Bering is reported to be visible from the mountains of the Peninsula, it would appear somewhat unreasonable to assume that the islands were uninhabited before the arrival of the Russians. A thorough investigation of the islands—something that might require a full season's work or even more—seems essential if a definite determination is to be made.

However, Dr. Hrdlička, a leading authority on anthropological matters, has stated that these islands were "not a stepping stone in the peopling of America." Dr. L. Stejneger, who made several visits to the islands for biological purposes prior to 1922, expressed the opinion that there was no pre-Russian population.

While making no claim to be an authority on this matter, I believe that further work is necessary in order to confirm Dr. Hrdlička's statement. If, as indeed may be possible, the islands were not peopled before the time of the Russians, it would seem to indicate that the Kamchatkan Peninsula was very sparsely inhabited, if at all, until comparatively recent times.

The Soviet islands appear to be fully utilized. All the different animals are raised under the supervision of scientists. The foxes, for instance, are fed, branded, and counted each year. The islands are divided into four sections, with four Aleuts in charge of and responsible for all the animals in their section. The villages were well kept and in good repair, the natives reasonably well clothed, the homes clean and neat. Vegetables were successfully raised at Nikolskoye, whereas in the Aleutians, with almost identical climatic conditions, it is claimed the season is too short.

It must be admitted that many favorable impressions were received from the Soviet islands although none were anticipated. Nevertheless, these favorable impressions were more than offset by something at first intangible. This intangible something permeated the air at Nikolskoye in particular and, to a lesser extent, in the outlying settlements. It took some time before realizing this oppressive sensation was caused by fear. Everyone appeared afraid of breaking some rule or of not doing the right thing. It was the accumulation of small incidents that brought to mind this fear complex. For instance, the men of the "army" refused to accept cigarettes when offered; Antipov, a gregarious person, hardly ever talked in the presence of Lazerof; and Aleuts always jumped into immediate action at any word from an official.

It would seem that actions and words could be misconstrued; therefore, actions and speech were restricted in the presence of others. Only at the reception parties, when drinking was taking place, did the Russians act without restraint. Lazerof, as head man, was afraid of no one on the island, but he gave the impression of being insecure, of being afraid of doing the wrong thing, which could presumably bring censure or worse from Petropavlovsk. This feeling of instability in Lazerof may have accounted for his obnoxious attitude on our first arrival aboard the "Tallapoosa."

Had it not been for this all-prevailing fear, this subjugation of freedom, it might have been said that here was colonization at its best. Unfortunately, it was merely typical Soviet totalitarian regimentation—successful indeed but only through force based on fear.

NOTE: The views I have expressed in the last three paragraphs are my firm convictions. However, the domination by fear was not noticed by at least one other visitor to the islands. An anonymous article in the Roman Forum *for June, 1940, differs in part with my own impressions.*

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Continued from page 247

and plausible outline of New Zealand culture history. His evidence makes it clear that the first inhabitants were Polynesians, a part of the earliest wave of distribution that spread from the Society Islands to the outermost reaches of Polynesia. These first-comers probably reached New Zealand around A.D. 950, bearing a culture that survived in various fringe groups while undergoing modification and change in the central homeland.

These pioneers in New Zealand, as their camp sites abundantly demonstrate, found a rich source of food in the moa—and in the bones of this species of bird, a valuable material out of which they fashioned a variety of articles. This first culture, Mr. Duff takes pains to stress, is not the conventional Maori one we commonly associate with New Zealand. It is a forerunner —a stage out of which, with additions brought by succeeding settlers from Tahiti, the subsequent Maori developments arose. This process as Mr. Duff envisages it was in part a self-propelled phenomenon, although the stimulus of new ideas and environmental adjustments are also recognized. In this reconstruction of pre-European culture history in New Zealand there is no place for the Melanesian influences that some scholars have suggested. It is a purely Polynesian affair, the local growth and evolution of an early version of Polynesian culture.

Much of the author's argument is based upon a comparative study of the other local cultures of Polynesia. In particular he leans heavily on the evidence provided by the distribution of adze forms and types of ornament. He conceives of culture spreading through Polynesia concentrically from a center located in the Society Islands, thus depositing the earliest forms on the outermost periphery of the area. There is much to be said for this hypothesis. It is, however, questionable how far this useful device can be carried.

Mr. Duff's book, the first on the subject, is a major contribution. It is readable, interesting, detailed, and critical. It merits careful consideration by anyone seriously interested in Polynesian history.

HARRY L. SHAPIRO

THE NEW PHYSICS

- - - - - - - - by Sir C. V. Raman

Philosophical Library, $3.75
144 pp.

THIS book is written by a noted Indian physicist, a Nobel Prize winner, and is phrased for the lay public. These brief essays were originally delivered as radio talks and, of necessity, touch only on the highlights of the broad subjects they cover.

The reader learns something of the building blocks the physicist has at his disposal and, through easy stages, is brought up to the threshold of present-day achievements. The average reader would find the going so hazardous beyond this threshold, dodging heavy particles, mesons or cosmic rays, or sunk without a trace by supermathematics, that the author wisely gives the reader but a peek. "The progress being made is so rapid that even the most eminent leaders of the science have had scarcely time to comprehend or understand, in its totality, the meaning of all the new knowledge."

To this reviewer the concluding chapters, "The Future of Physics" and "The Scientific Outlook," are outstanding in their lucid summary of advanced physics for the layman.

Much of the data given in this book should already be known to the educated reader. The author discusses light and color, the soil, water, weather, atmospheric electricity, et cetera. We have come a long way in understanding and using phenomena in these categories. Perhaps some of the older physical concepts were fallacious in the light of modern ideas, but for many of these obvious manifestations a weak explanation did not stand in the way of some degree of progress. The ultimate degree of progress with the new physics as the rational background may be something quite outside our experience.

For the most part the early chapters treat of things a man can see, touch, or experience by a means he can understand. Therefore the older school of thought does not seem so quaint. The new physics deals with abstractions and intangibles. To the layman the quaint thing about this picture is that the new physics works.

HAROLD E. ANTHONY

UNDISCOVERED SCOTLAND

- - - - - - - - - by W. H. Murray

The Macmillan Co., $3.50
252 pp., 37 illusts.

THIS book was written by a mountaineer—an expert at his craft—especially for his fellow-craftsmen, and at first the technical terms used in describing the mountains he has scaled may be slightly confusing to the layman. As one reads on, however, such matters take up their correct relationships, and one becomes absorbed with the author's smooth and easy writing, his excellent and descriptive choice of phrase, and the rich guttural Gaelic names of the areas and peaks of which he tells. Now and then a pawky little vein of humor creeps into the writing as he compares himself, always to his own disparagement, with his climbing companions. And who, raised on John Buchan or Compton Mackenzie, could long feel a stranger to such places as Glen Affric, Coire nan Lochan, and Garbh Bheinn?

There are various anecdotes in the book, but in the main it is a series of descriptions of climbs in the Northern Highlands. The "undiscovered" part of the title refers to the glamorous and glorious land atop the mountains and peaks, mainly near the district of Glencoe, known only to Mr. Murray and his fellows. A number of the ascents are "firsts," and the author has deposited his records, maps, and diagrams with the Scottish Mountaineering Club for the benefit of later climbers.

To me, whose mountain-climbing has been done only in tropical surroundings, the thought of ice-covered rock is little short of terrifying. However, these perils are modestly dismissed by Mr. Murray, and, indeed, he sometimes seems to prefer them. The Great Slab of Leac Mhor, a rock-climb, or perhaps the climbs on the Island of Rum, sound rather less fearsome to me, but I would not call any of them a gentle country walk, ice or no ice. It is difficult to comment adequately, because one wishes to draw attention to so many different facets in the book.

All through it there is the entrancing force of sheer, unqualified enthusiasm; one appreciates the fact that to a mountaineer, as perhaps to a scientist, the world has nothing higher to offer than the attainment of his goal. And unless he is striving toward it, he is just wasting time.

The photographs with which the book is illustrated are excellent. To anybody with a lust for achievement and eyes to imagine, I recommend it heartily.

GEOFFREY M. TATE

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ANIMAL IQ
THE HUMAN SIDE OF ANIMALS

PATIENCE REWARDS THE ANTLION

continued from page 263

merely goes to work weaving silk about itself.

But the ant lion is under fine shifting sand, and if it did not use a special technique, its cocoon would contain not only itself but a lot of sand. If you examine the cocoon of an ant lion with a hand lens, you will see that there is no sand *inside*. The secret was exposed in 1884 in Germany by Redtenbacher, who says, "The larva while spinning lies on its back with its abdomen curved ventrally and, while the sticky thread is issuing, moves the spinneret about in circular, spiral and confusedly irregular paths. Since the sand grains are thus cemented together by the sticky strands, there arises a confused band of sand, which is gradually consolidated to form a hemisphere . . . Later it turns over and the lower hemisphere is completed and attached to the upper one." Thus the creature builds a cocoon without getting sand inside. Within this cocoon, buried in the sand, the larva transforms into the pupal stage, and for nearly two months it remains in the "sleep of transformation."

One day, however, the side of the cocoon splits open, and the pupal ant lion pushes itself to the surface of the sand. Its skin ruptures along its back, and out comes a bedraggled creature. At first it is pale and delicate, but within a few hours its integument hardens and the limp and crumpled wings expand into transparent, gauzy membranes that carry the transformed creature high over the sands where it had its humble beginning. The lowly, ugly creature that was only a third of an inch long has transformed into a winged adult approximately three inches across and somewhat like a dragon fly in general appearance.

After her years at the bottom of a pitfall, the female has only a limited time, a few days, in which to mate and return to the sand to lay her eggs. Like an insect Cinderella, her period of gaiety is quite short.

BULLDOZERS VS. TROWELS

continued from page 253

growing season in the higher country, although the water supply was more adequate there, was too short for corn to mature. The small number of favorable fields for planting further limited the population this area could support.

Long drought periods reduced the natural vegetative cover, induced soil erosion and the channeling of valley floors—arroyo cutting—and this in turn led to the lowering of the normal water table. The heavy concentration of people in Chaco Canyon, where planting fields were limited, probably ended in migration from the above causes, prior to commencement of the great 1286-1299 drought of 23-years duration which largely and finally depopulated almost the entire area of the Colorado Plateau.

We know some of these facts because archaeologists accompanied the construction crews of the El Paso Natural Gas Company. Without the archaeologists, the pipeline would have been just another ditch, and a very destructive one, however benefical. Luckily, a man with Dr. Nusbaum's background and interests was on the spot, and he knew the significance of what was about to happen. His connection with archaeology began in 1907, when he went on an expedition to Mesa Verde which established the present boundaries of that National Park.

He has been associated in various capacities with museums interested in Southwestern anthropology. He organized and was the first director of the Laboratory of Anthropology in Santa Fe, New Mexico. He is now Senior Archaeologist for the National Park Service and Consulting Archaeologist for the Department of the Interior.

The men of the two crews—Francis Cassidy and Bill Bullard of the New Mexican crew, and Paul Ezell and Wesley L. Bliss of the Arizona one—were all graduate students in anthropology at various universities. All had field experience in Southwestern archaeology. As a result of applying this experience, 146 sites have been salvaged.

An unknown quantity of sites are still threatened by pending projects in various parts of the country. This job covered 451 miles; 2790 more miles of pipeline are contemplated in the Pacific Northwest and 3650 miles in the Southwest, not to mention other construction jobs. Even if these pipelines encounter only a third as many sites, over 500 more sites are doomed.

The example of co-operation between business and science furnished by the pipeline can be extended to cover other potentially destructive work. The bugaboo of cost is frequently raised. Archaeologists as well as laymen may be interested to know that this whole scientific program cost approximately one twentieth of one per cent of the total for the construction job. Certainly this was a small price for saving the evidence of cultures vital to the reconstruction of man's past.

Important Notice

Readers are reminded that NATURAL HISTORY is not published during July and August. Those who expect to be away after September 1, however, and wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary. Please give also the date of expected return to permanent address.

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NATURAL HISTORY

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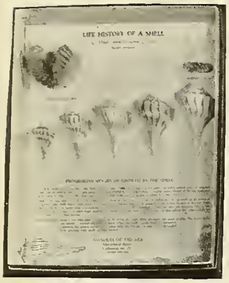
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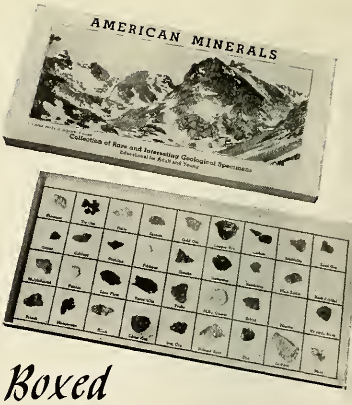
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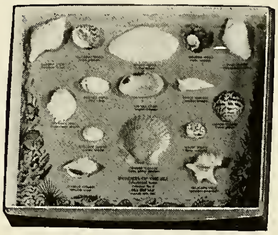

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L E T T E R S

The "Ape" That Wasn't an Ape

SIRS:

Some years ago I read that a large and strange ape, as depicted in the accompanying illustration, was discovered in Venezuela. An ape, as distinct from a monkey, would seem to be in disagreement with what we know of animal evolution in South America. I have not been able to find any further information regarding the beast in books or scientific magazines. Could you identify the creature and tell me the truth about it?

I. CAMARA

Rio de Janeiro,
Brazil

The following information is offered by Dr. G. H. H. Tate of the American Museum's Department of Mammals:

This fantastic story of an alleged South American anthropoid began in 1929. In a variety of publications, Dr. George Montandon attested to the fact that Dr. Francis de Loys, a French traveler in western Venezuela between 1917 and 1920, had reported the presence of such animals. Montandon reproduced in support of his contention a photograph of a large dead spider monkey seated on a kerosene case with its tail parts concealed. Montandon proceeded to solemnize this "discovery" by giving the creature the technical name of *Ameranthropus loysi*.

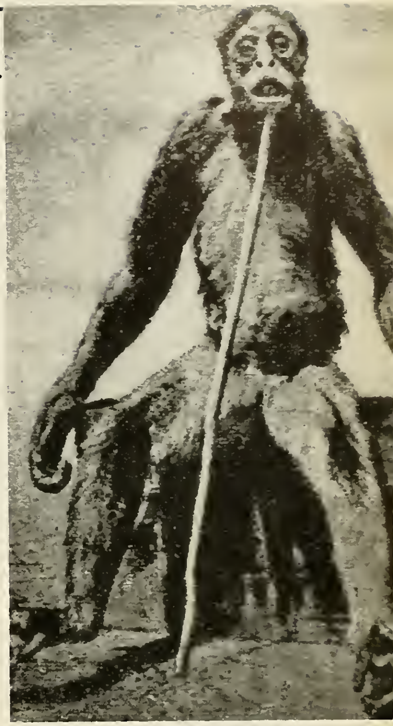
Rebuttal was quickly forthcoming. Sir Arthur Keith in *Man*, vol. 29, pp. 135-136, easily demolished the "new anthropoid." Keith stated flatly that the animal was an *Ateles* (Spider Monkey) and objected to the offhand way in which Dr. Loys remarked that the tail was completely absent—"as if it were a matter that required nothing more than mention . . .

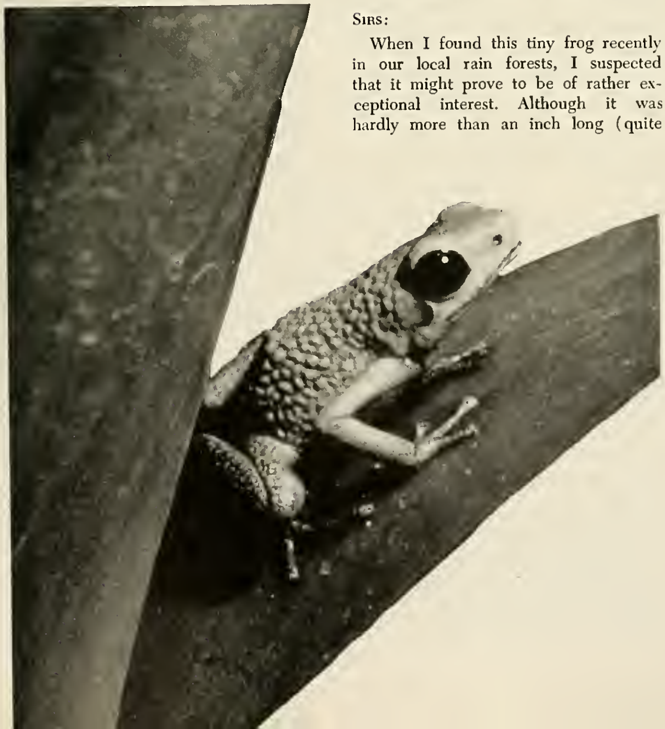
"A photograph of the animal from behind would have clinched matters," Sir Arthur Keith continued. "The problem of identification is further complicated by the discoverer, who has, after removing skin and skull, lost them . . . Thus the only original document . . . is the photograph on which Dr. Montandon's description is based . . . "

Other scientists, including Ashly-Montagu, expressed equal doubts.

In 1930, Dr. Montandon answered his critics with a lengthy summary (*Archivio Zoologico Italiano* [Torino], vol. 14, pp. 441-459), attempting to bolster up his argument on the basis of the large size of the monkey. He cited no less than 20 papers on *Ameranthropus* in his bibliography.

No further response was forthcoming.





Frogs and Arrow Poison

SIRS:

When I found this tiny frog recently in our local rain forests, I suspected that it might prove to be of rather exceptional interest. Although it was hardly more than an inch long (quite a common size for tropical American frogs, by the way) its coloring was quite spectacular. I photographed the handsome sprite, and sent the picture to my good friend Dr. E. R. Dunn, of Haverford College, who was kind enough to identify it as *Dendrobates pumilio* Schmidt. He tells me that this photograph is the first indication of the occurrence of the species on the Pacific slope of Costa Rica. Although I have never seen it here before, it is apparently common enough in some localities on the wet Atlantic slope of Nicaragua, Costa Rica, and Panama. The first, and by far the best account of these creatures is that by Thomas Belt, who saw them in Nicaragua nearly three-quarters of a century ago. Belt had become considerably interested in warning coloration in insects (as typified, for example, by the brightly colored, but ill tasting Heliconid butterflies). So far as we know, he was the first to observe warning coloration in amphibians; hence his account, quoted below, has considerable historical significance.

"In the woods around Santo Domingo there are many frogs. Some are green or brown and imitate green or dead leaves and live amongst foliage. Others are dull earth colored, and hide in holes

▲ Builder of dunes: wild sea oats along Bogue's Bank in North Carolina

and under logs. All these come out only at night to feed, and they are all preyed upon by snakes and birds. In contrast with these obscurely colored species, another little frog hops about in the daytime dressed in a bright livery of red and blue. He cannot be mistaken for any other, and his flaming vest and blue stockings show that he does not court concealment. He is very abundant in the damp woods, and I was convinced he was uneatable as soon as I made his acquaintance and saw the happy sense of security with which he hopped about. I took a few specimens home with me and tried my fowls and ducks with them, but none would touch them. At last, by throwing down pieces of meat, for which there was a great competition amongst them, I managed to entice a young duck into snatching up one of the little frogs. Instead of swallowing it, however, it instantly threw it out of its mouth, and went about jerking its head as if trying to throw off some unpleasant taste."

It is perhaps of some further interest that the Indians of Darien Province in Panama and in the adjacent Colombian Choco have long been aware of this peculiarity and have used this frog, and a closely allied blue and black species, for the manufacture of an arrow poison. Apparently a number of the frogs are spitted on a stick and toasted over a fire, the exudate from the skin providing the active principal. So far as known, this is the only nonvegetable arrow poison in the American tropics.

Paul H. Allen

Esquinas Experiment Station
Costa Rica

Island Builder

Sirs:

Along long Bogue's Bank, as natives call the barrier isle on the coast of North Carolina, the strong sea winds are constantly fighting to level the sand dunes. Although there are shrubs, dwarf trees, and creeper vines growing up the landward side of the dunes, these stop short below the top—unable to withstand the rigor of salt sea-spray and wind-blown sand. But alone atop these dunes stands the wild sea oats or spangle grass (*Uniola paniculata*), which gracefully float their panicles of flowers upon salt-poisoned winds. It is this head-high grass that has stopped the sand and built the Carolina strand.

Paul D. Harwood

Ashland, O.

A Poisoned Valley

Sirs:

Under the title "An Invisible Deathtrap," you called attention to a bubbling pool in Yellowstone Park whose gases were fatal to a considerable number of small animals (October, 1950). I ran across a reference to another "Poisoned Valley" in a new chemistry text, *General Chemistry* by P. W. Selwood. This valley is three miles from Balor, Java, and it was said that a dog was observed to fall unconscious in ten seconds and to die in seven minutes. One chicken thrown into the area was dead when it hit the ground and the other lived one and one-half minutes. In the valley were noted skeletons of " . . . human beings, tigers, pigs, deer, peacocks, and all sorts of birds," according to observations in 1830. I am wondering whether you can give me further information about this spot.

James S. Legg
Associate Professor
Biology Department

Whitworth College
Spokane, Washington

The following comments are offered by Dr. John T. Zimmer:

According to the original description referred to (from the *Edinburgh New Philosophical Journal* of 1831), this valley was considerably larger than the pool described in Natural History, for it measured about half a mile in circumference and from 30 to 35 feet deep. The sides were covered with trees, but the bottom was flat and without vegetation. A suffocating smell was noted both outside and inside the hollow, but not at the rim. The party descended to within 18 feet of the bottom without difficulty in breathing but did not attempt to go lower. Smoking fumaroles existed not far from the road at the foot of the mountain.

The exudation was described as carbon dioxide by M. Neumayer, writing in *Erdgeschichte* in 1920. Such gases of volcanic origin (carbon dioxide and hydrogen sulphide) are apparently plentiful in

Continued on page 335

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—No. 7
SEPTEMBER, 1951

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From a color photograph by Roy C. Wilcox

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You will find Natural History *Magazine indexed in* Readers' Guide to periodical Literature *in your library*

THE COVER THIS MONTH

One of our interesting birds of prey is the Osprey or Fish Hawk, shown here in an unusual color photograph taken by Mr. Roy C. Wilcox. The North American representative of the species is found throughout the United States and most of Canada and Alaska, wintering farther south, from the Gulf coast as far as Paraguay and northern Argentina. Since it feeds principally upon fish, it makes its home near water, salt or fresh. It can sight its prey from heights of 30 to 100 feet and drops with a splash, striking the water breast-first, sometimes going completely under. The fish may weigh up to four pounds or more and is carried in the bird's talons, headfirst. Often the Osprey is victimized by the Bald Eagle, which forces it to drop its prey and then catches the food in mid-air before it reaches the water.

The nest is usually placed high on a tree or pole but sometimes on the ground. It is a bulky structure, sometimes as much as 20 feet across and 6 feet high, composed of nearly every imaginable sort of material. It is occupied year after year, sometimes for as long as 40 years, with additions made until its weight may break down the support. John T. Zimmer

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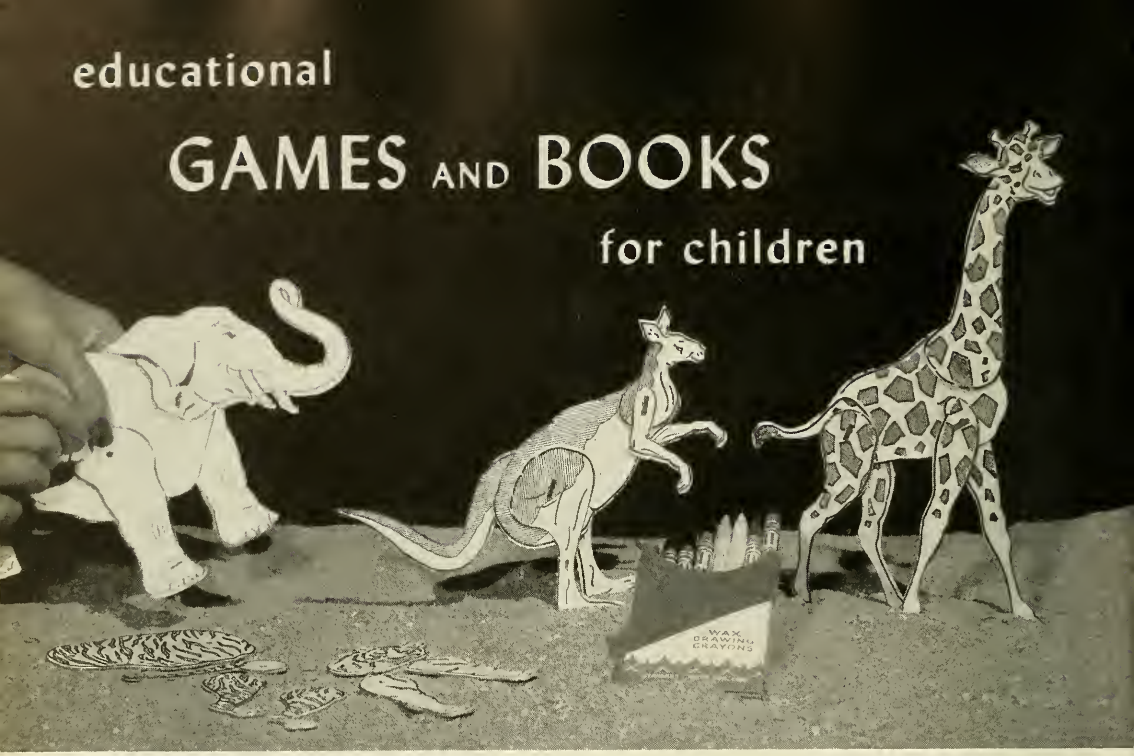

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AMERICAN WILDLIFE AND PLANTS

- - - - - by Alexander C. Martin,
Herbert S. Zim, and
Arnold L. Nelson

McGraw-Hill Book Company, Inc., $7.50
500 pp., over 700 illusts.

THE title page of this book describes it as "A Guide to Wildlife Food Habits: the use of trees, shrubs, weeds, and herbs by birds and mammals of the United States." Since it has been prepared under the direction of the United States Fish and Wildlife Service, it is authoritative and draws upon the most exhaustive file of such data in existence.

The subject is developed in a logical manner. The reader is informed about the many ways in which animals derive food from plants, the availability of this food, food preferences, the variation of food habits with the seasons, the importance of plant life as protective cover, and so forth. Cultivated crops play an important part in the dietary plan of some animal life, and, to some degree, many of these animal boarders pay for their keep in controlling factors inimical to the desired crop.

There is a chapter on wildlife food-habits studies to tell how the basic data for the book is secured, and this is followed by another chapter with instructions for interpreting the information in the book.

Most of the pages are devoted to covering the plant-animal relationship from two angles. The first approach places the emphasis upon the animals. They are taken up systematically—birds, mammals, fishes, amphibians, and reptiles, treated as the most useful identifiable group, often as species, and the plant food is listed for each. The other presentation is from the plant aspect. The plants are systematically treated, and the animals that feed upon them are arranged in the proper pigeonholes. In this way the information desired may be sought from either side of the relationship.

Helpful bibliographies appear frequently at the end of each significant discussion. The book is well illustrated by excellent line cuts and by maps to supplement the text. There are more than 700 illustrations, and in every way the book is a credit to the publisher.

This is a very good reference for anyone who loves nature or wants to know more of what is happening about him. It should prove a classic in its field and a must for every naturalist.

HAROLD E. ANTHONY

NATURE'S WAYS

- - - - by Roy Chapman Andrews

Illustrations by Andre Durenceau
Crown Publishers, $3.75

206 pp., 144 illusts. (72 in full color)

THIS book of attractive appearance is also a pitfall for the unwary reader because of errors (obvious to the expert) and misleading statements that create erroneous impressions.

In this brief review it is not possible to give much on the merits and faults of the book. Because the faults are more likely to escape the average reader than are the creditable features, more space must be given them.

The book is well printed, the color plates catch the eye, and trustworthy data on a wide variety of topics is given. Under these circumstances what a pity that Homer nods. One gathers that the book is the product of several minds, and Dr. Andrews may not be directly responsible, for example, that the African antelope, on page 29, are identified as the American pronghorn. Many readers will catch this blunder at once; for them no harm has been done.

But there are less obvious misrepresentations to fix an incorrect idea in the mind of the reader. A deplorable striving for the dramatic and unusual appears in some section headings. "The Bear that Lives on Ants" tells about the ant bear, not a true bear at all. But this confusion of names is not clarified, and a child will believe the beast is a bear. The most aggravated example of misdirected identity deals with "Porpoises Once Lived on Land." Of course this is not so. Ancestors of porpoises lived on land, but they were not known as porpoises then nor did they remotely resemble what we know as porpoises today. Other instances of this play on words do violence to accurate natural history.

It is somewhat surprising that the speed of the deer botfly is given at 800 miles per hour plus. This absurd claim of Dr. Townsend was pretty well exploded by cold analysis and scientific analogy some years ago. It is to be doubted that the insect can fly any faster now than it did then.

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NATURE THROUGH THE YEAR

- - - - - - - - - - by Frances Pitt

Macmillan and Co., $3.75
300 pp., 133 illusts.

READING this book is akin to spending a year in the English countryside with a friend who is a keen observer and a good photographer, and who has the ability to describe her observations in a simple and pleasant manner. Miss Pitt takes the reader, month by month, from January to December, on a journey through Nature's ever-changing year. The book is organized along the lines of a very informal journal kept not by a scientist but by a person who loves the countryside and who has learned to note the interesting behavior of its many animal inhabitants. Not all the creatures are wild; interspersed with stories of the wild animals are tales of the inhabitants of Miss Pitt's barnyard.

The book is amply illustrated with photographs taken by the author. The only regret is that they are all black-and-white. The deep feeling Miss Pitt seems to have for animals is sometimes revealed in her interpretations of their behavior. Occasionally she attributes to some of the subjects traits that are human and are not necessarily animal. Those who want their nature study on a strictly scientific basis may object to this, but most readers will find the "flavor" of the English countryside, which this book has captured, ample reward for their time.

JOHN R. SAUNDERS

WATCH OUT FOR THE WEATHER

- - - - - by Jacqueline Berke and Vivian Wilson

The Viking Press, $2.95
256 pp., 31 illusts.

ARE you planning to retire, go into business, get married, or go on a vacation? Then be sure to consult your meteorologist! According to the authors of *Watch Out for the Weather,* we are not watching out as much as we should, and all of us could profit by taking fuller advantage of known weather effects.

Furthermore, the authors are convinced that progress has been impeded in many fields due to the failure of lawyers, educators, physicians, architects, and business men to reckon properly with weather and climate.

Jacqueline Berke and Vivian Wilson have written a most interesting book in which the main emphasis is on the present status of medical meteorology and "climotherapy." Interspersed are chapters on artificial rainmaking, atmospheric pollution, and the application of weather science to business and architecture. A chapter entitled "Modern Weather Men" does not discuss such pioneers of modern meteorology as Rossby and Bjerknes but contains instead biographical sketches of Prof. Ellsworth Huntington, the great geographer and climatologist, and two physicians who have also pioneered in the study of the influence of weather factors on human health and disease, Dr. Clarence A. Mills of Cincinnati, and the late Dr. William F. Petersen of Chicago.

The authors are concerned over the apathy of physicians and others to the potential great rewards that seem almost certain through a proper study of weather and climate and their effects. Their concern is illustrated in a stinging rebuke to those who have located our National Leprosarium in Louisiana "where the climate does its best to ape the tropics," when there is some evidence suggesting that leprosy loses its virulence when imported to the more northerly climates of Minnesota and North Dakota.

On the other hand, they were perhaps pleased by the trend indicated in the series of papers presented last January when physicians and meteorologists joined hands in New York at a symposium on medical meteorology sponsored by the American Meteorological Society.

C. P. MOOK

THE MIGRATION OF BIRDS

- - - - - by Frederick C. Lincoln

U. S. Fish and Wildlife Service
Dept. of Interior, Washington, D. C., 30¢
102 pp., 23 illusts.

FOR many years Mr. Lincoln has been writing about the migratory movements of North American birds, utilizing the vast accumulation of records—now containing over three million entries—maintained by the Service of which he is an official. In the present circular he has summarized much of the preceding material and brought it up to date, writing in broader terms. More detailed discussions will be found among the papers by numerous authors listed in the bibliography appended to the present account.

Much has been learned in recent years concerning this fascinating subject, but there are still problems for which satisfactory answers are not yet provided. Chief among these are the factors that periodically induce and regulate the migratory movement and the marvelous powers of orientation that birds possess. We know more about the routes of migration and the "flyways," the speed of flight, and the very different speed of migration, the altitudes of flight, vagrant movements,

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and similar matters. As an interesting and useful summary of much of our present knowledge and theory regarding North American birds, Mr. Lincoln's circular can be thoroughly recommended.

John T. Zimmer

AMERICAN RESOURCES—
Their Management and Conservation

- - - - - - by J. Russell Whitaker and Edward A. Ackerman

Harcourt, Brace and Co., $6.75
497 pp., 76 figs.

THIS book fully lives up to its title. Although the coverage of any given aspect of these vast problems is necessarily brief, the scope is all-inclusive. The treatment is factual and, while the authors do not predict any dire catastrophe to the country in the near future, they make it abundantly clear that we shall pay an increasingly heavy price for our lack of wisdom in handling our natural resources. How the necessary changes are to be brought about within the framework of our democratic, private enterprise system, if education and enlightened self-interest fail or are too slow, is the great unanswered question that assails the reader on every page.

In the 43 years since Theodore Roosevelt called the White House Conference of Governors to consider these problems, we have made great strides in working out methods of preventing and fighting forest fires, conserving soil, and managing forest and grassland communities and their wildlife. However, these techniques are only effective in so far as landowners can be persuaded to make use of them or Congress will appropriate funds to apply them on public lands.

American Resources demonstrates very clearly that conservation is today a political and social problem. Education is one aspect; but it seems evident that in some cases the state, through land-use zoning and other regulatory steps, will have to protect the interests of future generations against those individuals of our own who are tempted to reap quick profits at their expense.

The book deals first with cultivated land and then in turn with grasslands, forests, water, and wildlife. The nonrenewable resources field, especially the problem of mineral fuels, is surveyed; and the recreation value of many resources is also recognized.

The footnote references constitute an excellent guide to many of the basic conservation documents of recent years. The wealth of maps, statistics, and specific results of recent studies of the rates of resource exhaustion make this an invaluable reference book for conservation chairmen and others who seek to present the overall story of conservation to the people of their community.

Richard H. Pough

THE HUMAN SPECIES
A Biology of Man

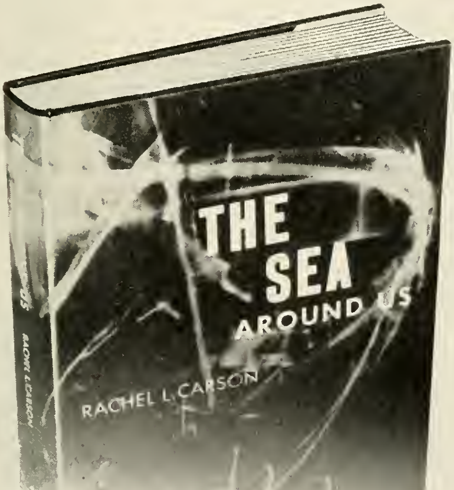
- - - - - - - - by Anthony Barnett

W. W. Norton & Co., $3.75
266 pp. 16 plates

MR. BARNETT has undertaken a difficult job in attempting to write a biology of man in 266 pages, especially since his selection of topics includes such rich fields as genetics, embryology, evolution, race, eugenics, sex differences, evolution of human society, food, and population dynamics. Even as an introduction to the subject, which this book obviously is intended to be, the problem of selection and compression is a formidable one. It would, therefore, be unfair to criticize the author for the omission of topics that might have been included. In fact, it is difficult to see how any more could have been added in the limited space.

Within the limitations suggested above, Mr. Barnett tells the reader a great deal

Continued on page 334



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—AUSTIN H. CLARK, staff member, Smithsonian Institute, in *Saturday Review*

"Miss Carson has made the story of the sea one of *the most beautiful books of our time.*"—FRANCESCA LA MONTE, Associate Curator of Fishes, American Museum of Natural History, in *N. Y. Herald Tribune Book Review*

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Sovfoto

WHAT MAKES
The Sovie

▲ **Emblems old and new.** Not until eighteen years after the Revolution was the two-headed eagle—symbol of the Tsars—removed from the Spassky Tower of the Kremlin wall. Here the five-pointed star with the hammer and sickle is replacing it

TODAY the safety of all civilization may hinge upon our ability to develop ways through which the behavior of the members of any large modern society can be made intelligible to the members of other societies. At the present time when nations want to agree on a course of action—in problems as varied as the establishment of an international control system for rare metals or the training of reliable civil aeronautical pilots—there is no assurance that the representatives of any one country will communicate what they *mean* to communicate to the representatives of any other country.

During World War II, we learned to try every method, however unlikely, to find a solution to problems that might mean the difference between survival and annihilation.

Sovfoto

The Red Square of Old Moscow, around 1890, and the same locality after the construction of Lenin's tomb. Crowds wait in line to pay homage to Lenin's memory. The stone execution block and the monuments to the liberators of Moscow in 1916 have been moved to make room for the parades

Character?

By MARGARET MEAD

Associate Curator of Ethnology,
American Museum of Natural History

Embryologists were set to stopping submarine warfare, crystallographers to discussing national policy. Now in this uneasy peacetime, most scientists have been sent back to their traditional tasks, and the intellectual ferment that occurs when an old problem is tackled in a new way has been allowed to subside.

But not altogether, for during the last three years the American Museum of Natural History has been taking part in research on the contemporary character and culture of the Soviet Union, which might at first seem almost as fantastic a venture as having an expert on biochemistry devise methods for classifying Oriental philosophies. If we say that the essence of the natural-history approach is first-hand observation of living creatures in their natural settings, it would seem that any attempt to come to conclusions about conditions behind the Iron Curtain is ill-placed in a natural history museum. Surely this is a task for those who work, not with living things, but with the traces modern man leaves on paper—government documents, production figures, ideological manifestoes. The museum scientist studying a primitive people is accustomed to noting the way the wrists of a hunter become taut on his bow or the way a native woman keeps her balance when her punting pole catches in the weeds. What bearing have these techniques of direct observation on the study of the effect on young Soviet citizens of an official statement that the Soviet Union has just "invented" an exact replica of some American machine, or with the meaning of a trial in which, when the accused refuses to confess, the trial is interrupted and is resumed only with his full confession to all the charges? How can the behavior of members of a modern society with a long history be illuminated by any method ex-

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(EDITOR'S NOTE) Challenging the old hypothesis that differences in national character are due to inherited factors, this article is an attempt to interpret in popular form the social, educational, and historical forces that have molded the personality of the Soviet citizen. Three years ago a group of research workers in anthropology, sociology, psychology, and political science joined to work on a project called Studies in Soviet Culture. The aim was to gather as much information as possible from refugees, current Soviet literature, motion pictures bearing the official stamp, political manifestoes, and other vehicles of Soviet philosophy, and on this basis to analyze the Soviet national character. All the original work was done in the Russian language.

The various lines of inquiry are being drawn together by the author of this article, whose book, Soviet Attitudes Toward Authority, *will be published within the month by McGraw-Hill. The book will give a report of the first year's work on this project and will contain an account of the personnel and methods of the research group who contributed to it.*

Readers will recall Margaret Mead's many writings, from Coming of Age in Samoa *and* Growing Up in New Guinea *to her recent* Male and Female, *all of which demonstrate her facility in applying the methods of anthropology and psychology to elucidate the interaction between education and original nature.*

Frederic Lewis photo

▲ Breakfast room in the Winter Palace of the Russian Tsars in St. Petersburg. The transformation of rooms like this is an important symbol of the Soviet revolution

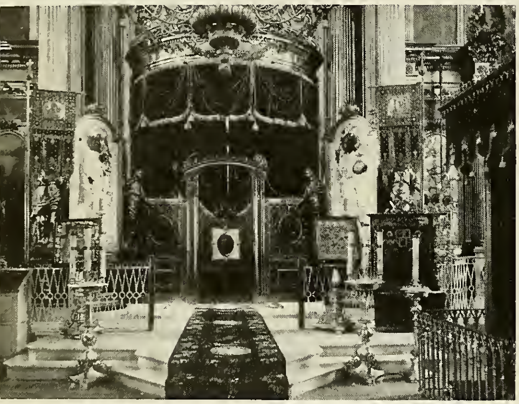
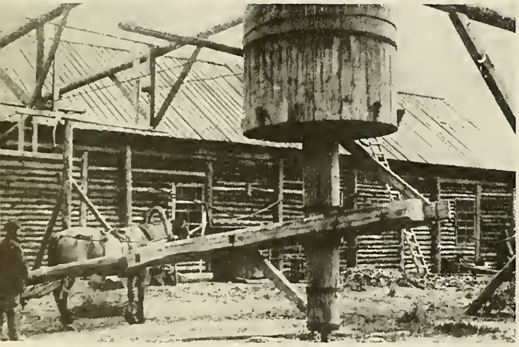


Photo by Herbert, from Frederic Lewis

The beautiful altar of the Solovesky Monastery in Moscow



Hirz photo, from Frederic Lewis

▲ This photograph, taken in the Vasilievsk region in Russia, shows the primitive methods still being used for the mining of "black gold"—oil. Crude devices of this sort co-exist with the most modern extraction machinery

➤ A scene in the Stalingrad tractor factory in 1946, where tractors are produced according to modern assembly line methods. American engineers helped to build this factory. It reached full production in 1932

Ewing Galloway phot

▲ Reading room for Soviet workers in former palace of the Tsar. The plant in the corner parallels the one in the preceding photograph. This is the Livadia where Roosevelt stayed

ВНЫЕ ПРАЗДНИКИ

Ewing Galloway phot

▲ An antireligious book exhibition in Moscow, arranged by the Pioneer's Organization in the "Red Banner" Club of the workers of the Poveletsk branch of the Moscow-Kursk railway

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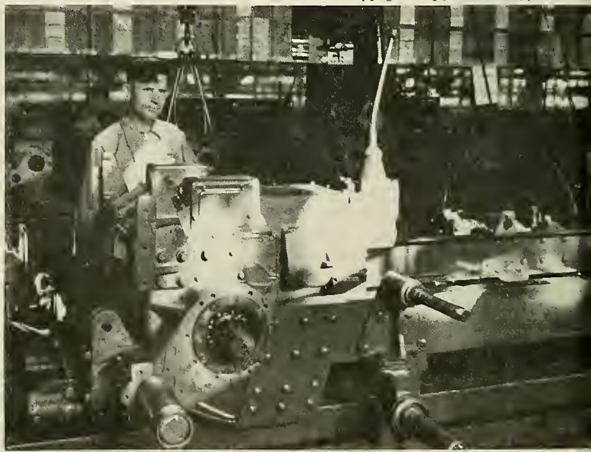


cept the time-honored one of simply referring everything that is being done today to past historical events?

Assuming that the anthropologist trained to study primitive man by direct observation could learn something about modern Russians if he looked, he can't go and look. He can't stand beside agricultural workers as they donate, under compulsion, a piece of "voluntary" Sunday work to keep the costs down. He can't mingle with a group on a railroad train who are busily exchanging rumors that there will or will not be more bread. What, then, has a natural history museum been doing in the field of Soviet culture?

Anthropologists bring to such an activity their own body of theory and their own tools. They assume that all human beings—of all races and languages, with and without writing—are the same order of creature with the same range of capacities. Regardless of the descriptive tags that people have invented in thinking about themselves or others, as when they speak of "Slavic souls," "Western genius for organization," or "Oriental mysticism"—anthropologists place man in nature among all living creatures and see him as a special kind of living creature born with definite potentialities and vulnerabilities. And anthropologists view all the differences—in language, in ability to think scientifically, in food habits and philosophy—as differences learned after birth. If a hundred Russian babies chosen at random were exchanged for a hundred American babies chosen at random, we assume that the Soviet-born babies would grow up to be indistinguishable from other children reared in the United States, and the American-born babies would be indistinguishable from other Soviet-reared children. So, while the differences in what Soviet parents teach *their* children and what American parents teach *their* children are to be explained by their disparate pasts, the question the anthropologist asks is: Given the context, given Marxism-Leninism-Stalinism, and given our American doctrines of the Rights of Man, how does a human infant, equally capable of becoming a believer in American democracy or in Soviet communism, learn to become one or the other? And just because anthropologists are trained in natural-history methods, they are not content with the kind of answer that says children reared in America become Americans by "imitation," by "habit." That's the sort of loose explanation once used to explain that a male bird knew that another bird was a female by "instinct." The Department of Animal Behavior at this Museum has spent two decades showing that the "instinctive" male response to a female can be analyzed into responses to very small details of clues given by color, movement, relative size, or degree of mobility, and even these clues have to be at least partly learned.

The idea that people grow up to be like the other members of their society because of vague concepts called "history" and "habit" is an explanation just as unsatisfactory and out-of-date as the idea that a male frog recognizes a female simply by "instinct." Anthropologists by using careful natural-history methods in simple societies have learned to study the ways in which human babies learn to be "Eskimos" or "Samoans"—just what the mother does, just how the infant responds, and just how the infant's response stimulates the mother to the next "traditional" piece of behavior. From studies of such things as the role played by the ways a child is carried and the way he is hushed to sleep or left to cry it out, we have built a theory of cultural learning. So we bring to the study of the unobservable new Soviet character a theory (one that has stood a good deal of testing) of the psychic unity of mankind and a theory of cultural learning.

Anthropologists, furthermore, are accustomed to relate each bit of the behavior of the peoples they study to all the rest of their behavior. When, as is the case with Soviet material, we have only very partial information (we have, for example, films the Soviet Government has permitted to be made, but we have no information about how the people laugh or weep when they see them), anthropologists have methods for making estimates of behavior about which we have no information from direct observation. Although such estimates are less accurate than the results of an on-the-spot study, they are a great deal better than nothing at all. They might be compared with the estimates of paleontologists who construct a complete model of an extinct animal when they actually have only part of its skeleton. They can do this because they know something about the way whole animals are put together, what spinal columns are like, how jaw bones fit. In the same way, the anthropologist who has studied small primitive societies knows something about how whole cultures fit together, and his knowledge can be used to interpret the kind of partial material we get from the Soviet Union.

With this set of anthropological theories and skills, we went about constructing a model of Soviet character today. First we built up teams of social scientists—specialists in Russian history, Russian literature, Communist Party history, and so on—who were to work with anthropologists and psychologists who knew something about cultural behavior and individual psychology. Then we took the following steps: First, we constructed a model of the national character before the Revolution—of the people of the area known as Great Russia. We did this by using interviews with old Russian *émigrés* and analyzing written sources, searching behind them for the living human beings who had written and believed them. Second, we constructed a model of the Russian intelligentsia, especially of the Bolsheviks, the group within the old intelligentsia who came into power at the time of the revolution. Third, we studied the official utterances of the Soviet regime—its theories of child care, pedagogy, and industrial organization; the films it permitted to be

Julian Bryan photo, from Acme

▲ A VIEW in a state nursery maintained for the children of mothers who work in factories. The children are kept in apertures in a special table

Press photo agency, J. Ryumkin

▲ A FACTORY WORKER nursing her baby in a public nursery, Moscow, March, 1947. In the Soviet Union, women are expected to work outside the home. Care for the welfare of mothers and children means giving women time off to nurse their children. The child here is not freed while being fed

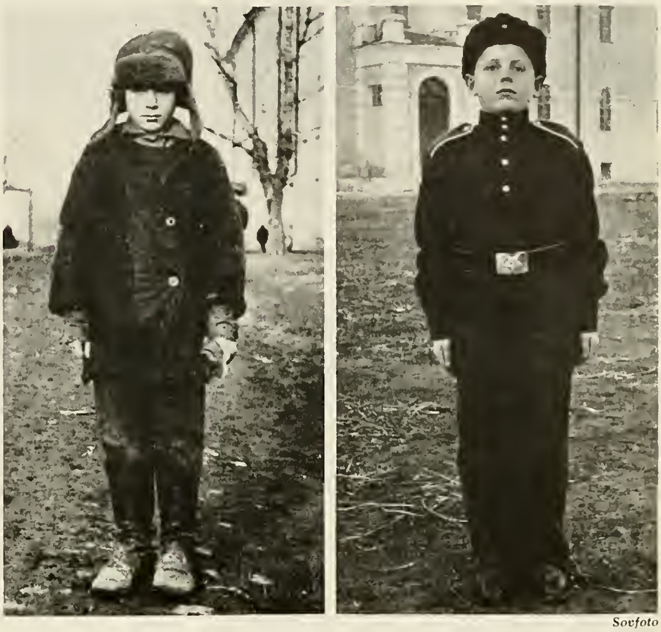
▼ SWADDLED new-born babies in a Soviet maternity home in Tashkent

Sovfoto

made and the novels it permitted to be published; the new folklore about Lenin and Stalin that it built up synthetically in the old poetic forms. When we had these three sets of materials—what the old Russians were like, what the new group who wished to change them was like, and what methods the new ruling group was using to produce the changes—we asked questions: What will happen to children of people like the old Great Russians if they are exposed to the conditions the Bolshevik leadership has set up? Judging by our knowledge of human cultures and individual human behavior, what can we expect?

When the Bolshevik leadership took power, they had control of a sort over a vast country, mainly inhabited by peasants, who had for centuries been subjected to the demands of an arbitrary and alien authority, which they had learned to circumvent and sabotage in a thousand adroit ways. The Russians were a people subject to extreme swings of mood and bound in close emotional dependence on a large group of people rather than tied closely to individual parents. They were a people with extraordinarily little interest in material things. They displayed an unusual tolerance of the evil in others, feeling that each human being had a right to live and to search for truth and that all human beings shared in the sins of others, but also that each human being was human and was to be treated accordingly. Characteristically, when political exiles were sent away, chained, to Siberia, crowds turned out to give them gifts of food and to grieve for their sorrows. When prisoners escaped, the people hid them, saying, "Why do they need this one when another, or two others, will do as well." They had great endurance in carrying rather than lifting; once a load was laid on his shoulders, a man could carry it a long way. They had great zest for life, and when there was an opportunity for dancing or drinking or feasting, they went about it with a vigor that was tiring even to watch if you came from another national background and had a lesser store of optimism. Although people were very poor, still it was believed that somehow, somewhere, there was enough for all. Speech and thought were studded with rapid kaleidoscopic visual images, and what was thought was felt to be as real as what was said or done. What was done might be undone—a friend could become an enemy and again a friend, or be both simultaneously—the borders between the thought and the deed, the loved and the hated, were rapidly shifting and uncertain. Hatred in particular was difficult to keep focused on a given individual, and anger could be dissolved by love into pity—the emotion that was valued above all others among those educated Russians who discussed such matters articulately. Time was unimportant; appointments could be kept hours late, meals waited for those who returned, what happened today was no earnest of what would happen tomorrow, but a new token of faith or friendship would be exacted.

When we studied how infants born in Russia were reared so that they represented this Great Russian character, instead of taking on some quite different character, certain aspects of their child rearing practices were particularly illuminating. The Russian baby was swaddled, as were most of the infants of Eastern peoples and as Western European infants used to be, but they were swaddled tighter and longer than were, for example, their neighbors, the Poles. A Russian swaddled baby was as stiff as "a sawed-off segment of a telegraph pole"—as one American historian of Russia described it to me recently—and they were swaddled day and night, only being undone to be fed,



Sovfoto

▲ **Soviet boy** before and after admission to the Kharkov Suvorov School in Chuguyevo, where he will be trained to be an officer in the Red Army. His clothes show that he comes from the upper 10 per cent of the population

Sovfoto

▲ **Breakfast** in the Suvorov School, where Soviet boys are trained to become army officers

➤ **A border guard** stands as proud and straight as the wooden marker guarding the Soviet frontier

Jack Benton, from Frederic Lewis

▲ RUSSIAN PEASANTS with crude hand tools of the kind used for centuries

Acme photo

▲ THIS is described as a "triumphal procession of laden carts," characteristic of the first delivery of crops to the government from a collective farm

Copyrighted photograph by John Strohm, from Acme

◄ A FORMER RED ARMY CAPTAIN, now serving as agricultural technician on the Mironovka Seed Selection Station in the Ukraine, has been photographed in uniform beside a knocked-out tank in a waving field of wheat. The close relationship between mechanized industry and successful warfare is stressed in this photographic choice

bathed, or changed. Day and night presented little contrast. Hands that were tightly bound inside the swaddling bands could not explore. During the first year of life the swaddled child, cared for by an old woman or a child nurse, was carried about, experiencing but never touching the teeming, vivid, highly charged world around it, being in it, but not of it. The Russian proverb says: "The eye sees but the tooth can not reach." This early period seems to have left a stronger impression on Russian character that the same period of learning does for members of many other societies in which the parents are more preoccupied with teaching skills appropriate to later stages of development, as Americans, for example, are preoccupied with teaching self-control, cleanliness, and autonomy.

So we find in traditional Russian character elaborated forms of these very early learnings. There is a tendency to confuse thought and action, a capacity for impersonal anger as at the constriction of the swaddling bands, but also for great warmth and outgoingness to individual human beings, a tendency to feel that all behavior is reversible —as the child who destroys his mother in his imagination can reconstruct her again in an instant. There is a low interest in reality in the sense that Americans think of the real world of measurable, ponderable objects, and a high interest in abstractions like truth or mathematics. There was too a concentration on the way one felt and less interest in the other person, although a high dependence upon being one of a group or a mass. (This does not mean that swaddling infants in a different culture would produce any of these effects. We are discussing here how Russians, with their traditional attitudes toward human beings as strong, full-passioned creatures needing external control, communicated with their young children so that their young children grew up to share these values.)

The Bolshevik leadership revolted against this vague, diffuse, mystical attitude, against hope without substance and dreams without effort. They wanted to forge a society that would use all the methods and tools of modern Western science, in which disciplined, purposeful, forceful, externally oriented people would forge forward relentlessly, tirelessly, toward a goal. Concretely, they wanted a people who would get to work on time, who would subject themselves to the one-way discipline of the machine, who would come to think in minutes instead of days. In place of the vague, diffuse family and village relationships that allowed the growing child to choose among half-a-dozen contradictory adult models of possible behavior, they wanted to substitute single consistent models, so that parents, teachers, and youth leaders would all present the same undeviating behavior lesson. In place of the old permissiveness for a child to live up to its strength and rest content, the Bolshevik educator wishes to substitute a character structure in which each achievement induces an accompanying discontent, forcing the individual on to greater effort. Where the old Russian had been tolerant, the new Soviet man must be intolerant of himself and of others. Where the old Russian had loved and hated the same person, fluctuatingly, concurrently, the new Soviet man must learn to focus hate continuously on the enemy, and love—absolute, undeviating, complete—on the Soviet State. Under the old system children had been ignored and subdued after they had learned to walk, with very little attention having been given to them. The sharp learnings of the first year remained the mold into which later impressions were fitted. The new child-rearing stressed early habit training, starting as early as three months, by exercise, discipline, activity, and emphasis on testing reality by action and manipulation. Instead of the old vagueness about the difference between thought and action, there was to be no thought that was not welded into action, no image in the mind that was not a counterpart of external reality.

But most of the Bolshevik leaders were, after all, Great Russians themselves. Their emphasis on action, on focus, on control was not the same as American emphasis on action, on purposefulness, on autonomy. American children learn to value autonomy and manipulative skill because they have always been rewarded for attaining it. Mothers and fathers who are not sure how strong and assertive their children really are urge and reward activity, planning, and autonomy. But the Bolshevik leader, in valuing these same goals, was reacting against a society in which these goals were *not* valued. He came to glorify this reaction, to insist that character could only be formed by "swimming against the stream." He fought down in others and in himself any temptation to express either the old patient endurance of life (which came to be identified politically with Right deviationism), or any wild, enthusiastic, unthinking pursuit of romantic dreams (which came to be identified as Left deviationism). Instead, all behavior must be exactly focused, not by some compromise between different positions, but by being exactly right, in a position in comparison with which all other positions are out of focus. (Politically this position is called the "Party Line," which may change abruptly, may appear contradictory, but which at the moment when it is promulgated by a leadership whose claim to leadership is just their ability to perceive the exactly correct line of conduct, to "hear the grass growing under the ground," is conceived as the correct and only possible course of action.)

This focus must be maintained by absolute control, by ceaseless vigilance over the self, by the new kind of consciousness that was being developed. (Politically, the counterpart of this untiring watchfulness is the omniscience of Stalin, who is represented in Soviet poetry as standing on the Kremlin with a spyglass in his hand, seeing all that goes on in the land, and by an omnipresent secret police.) The control over the self must be matched with control over others, over their every act, their every thought, their every impulse. If the external world did not match the expectation of the leadership, it must be made to do so. Novelists who represented life in the Soviet Union as contrary to what life should be in a communist state were condemned as political traitors. Individuals who were believed to feel hostile toward the regime were given trials that were essentially dramatizations of crimes they might have committed, had they followed their feelings, for which they could then be sentenced to ten years' hard labor.

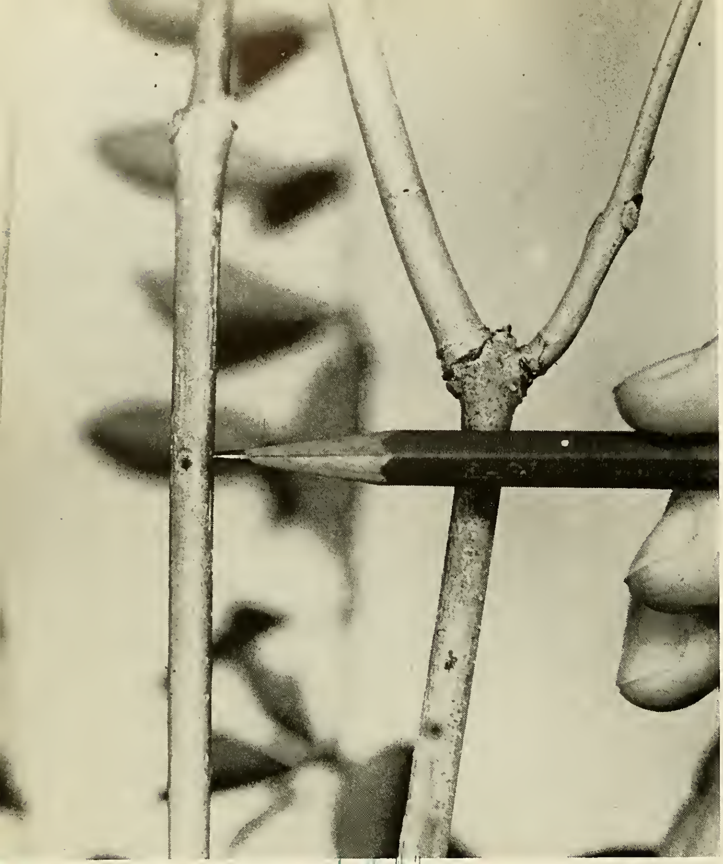
But the Bolshevik leadership, although some of its aims were new, still had a great deal of the old Great Russian character structure. As they fought against their own traditional character, the defenses that they erected partook of the characteristics against which they fought. As they tried to substitute reality for the old, idle dreaming omnipotence of thought, a new kind of omnipotence of thought that made them believe they could manipulate reality in any way they liked took its place. As the old Russian atoned in his mind for a

Continued on page 336

TRAINING—PHYSICAL AND IDEOLOGICAL: *At left*: Two thousand school children taking part in a sports festival at the Stadium. *At right*: A scene at an art exhibit in Odessa, showing pupils and their teacher. The piece of sculpture portrays a working man and his wife and two children being evicted from their home in a capitalistic country

Ewing Galloway photo

Acme pho



▲ THE ENTRANCE HOLE to the nest is about the size of the lead in a lead pencil

an ANT *that* USES ITS HEAD

This living door—the head

By Ross E. Hutchins

All photographs by the author

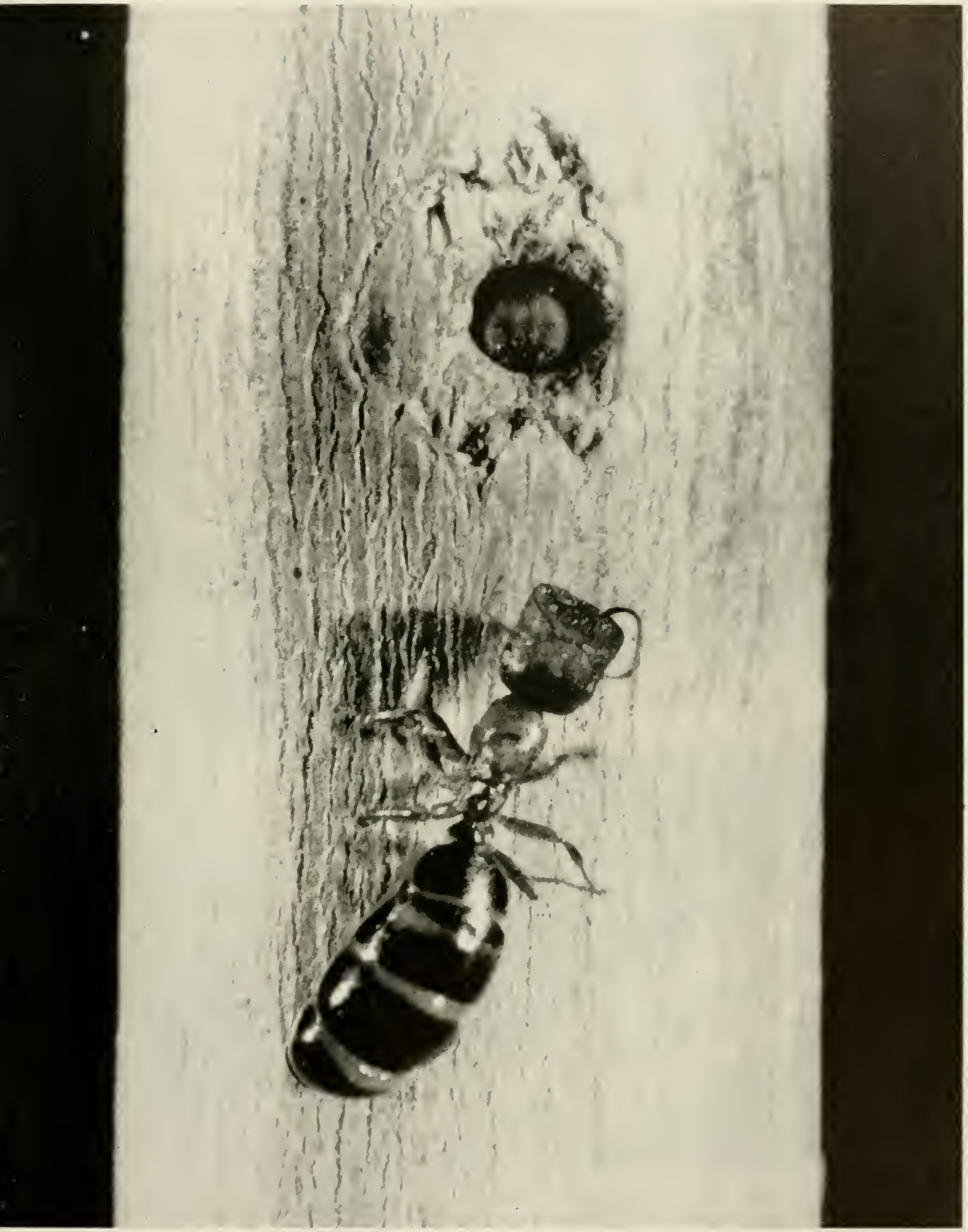
PERHAPS if the human race survives the vicissitudes of the Atomic Age and of other ages whose hazards are yet unguessed, we will have developed, in a million years or so, individuals in our society who are especially adapted to do certain tasks. A wild thought, perhaps, with a creature so independent as man, but that, at least, is how many of the social insects have evolved.

Many ants and termites have various castes, whose members differ in size and often in bodily form and specific structures. These differences enable them to carry out different functions in their colonies, and sometimes the differences are rather extreme. Certain individuals in many ant colonies have large jaws, for example, and their specific function is the defense of the colony. The worker caste has become so highly specialized in some cases, as for instance in certain Amazon ants, that they cannot even feed themselves, being entirely dependent upon their slave ants.

There are numerous examples of such specialization among insects, but one of the most interesting cases is that of the Colobopsis ants, first cousins to our common Carpenter ants.

Queen Colobopsis looks pretty much like any other ant. After her nuptial flight she runs about, to and fro on ground and bushes, until she happens to climb upon the right kind of shoot, usually white ash. She gnaws a small hole in the plant and penetrates the soft pith within. She excavates downward a short distance and then deposits several white eggs. This is her first step in establishing a new colony. Once in her cell, the queen never leaves it.

Time passes, and the eggs hatch into tiny white grubs. She busily feeds these, frequently handles and licks them, and stands over them bopsis ant—opens only when a member of the colony gives the "password"

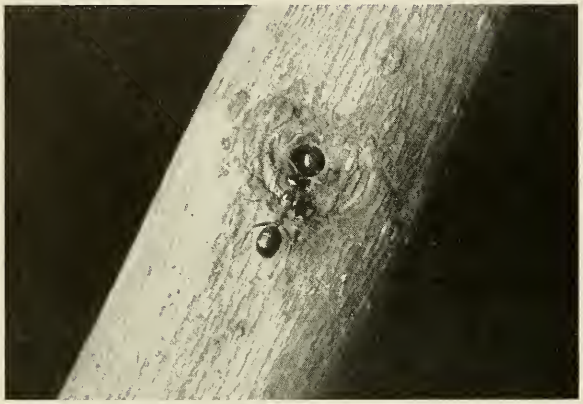


▲ A RETURNING GUARD, approaching the entrance. Note the pluglike head of another guard in the entrance hole almost constantly. At the end of several weeks, the young ants have developed into pupae, and they no longer must be fed. This is their resting stage. Soon, however, these pupae transform into adult ants.

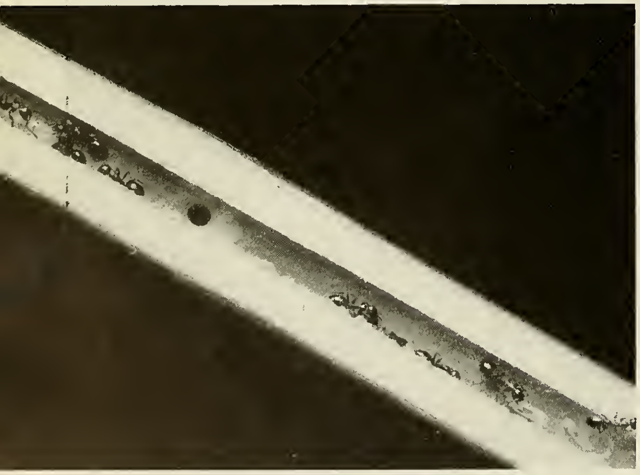
Now, if you will examine these individuals closely, you will find that they are not all the same. Some of them look pretty much like the queen, although smaller; but others are larger in size and have strange, pluglike heads. These individuals belong to the guard caste, and one of them is almost always on duty at the entrance to the nest, closing the opening with its stopper-shaped head.

When a worker of the colony comes up the tube toward the exit, ready to leave, the guard backs up and lets it out. When the forager returns, mounts the twig, and touches the portal, the guard pulls away, in response to some antlike equivalent of a password. Rather than any form of symbolic "Open Sesame," in all probability this is simply a few gentle taps of the forager's antennae, which serve to rouse the portal to action if accompanied by the familiar colony odor.

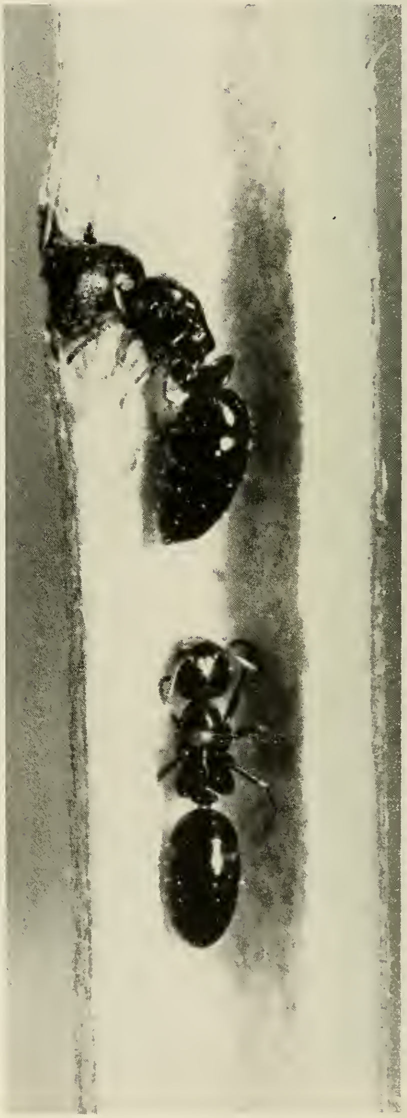
Thus, the especially adapted head of the guard forms a living door which closes the nest entrance to all except members of the colony.



▲ Here the returning worker is actually photographed in the act of tapping on the guard's head—the "open sesame" that will lead to admittance



▲ Comparatively normal activity goes on in the colony when the twig is split open. Here the ants care for their young



➤ This posed picture of a split twig shows how the guard plugs the entrance with its head

Courtesy Standard Oil Company (N. J.), Webb photo

▲WORKERS picking Tabasco peppers at Avery Island, Louisiana

SOME LIKE IT HOT

The peppers that soothe your palate have burned their names into the pages of history and have been used both as medicine and poison gas

By CHARLES B. HEISER, JR.
Botany Department, Indiana University

IN 1493, Peter Martyr wrote that Columbus had brought home with him "peppers more pungent than that from the Caucasus." Since that time the American red and green peppers have become widely known as a spice and as a salad plant, but the uses of peppers have been far more numerous than this. In the past—and even in modern times—peppers have been used in medicine. At one time they were used for dropsy, colic, ague, toothache, black vomit, and gout. At present, they furnish an ingredient in preparations to relieve throat irritations and also in an application to stop children from thumb sucking and nail biting. A teaspoonful of cayenne pepper in water is reportedly a remedy that really works for seasickness, although some people might prefer the malady to the cure.

Some varieties of red pepper are so hot as to have produced a burn requiring medical attention. According to several sixteenth-century observers, the smoke from burning peppers was used as a poison gas by

Ewing Galloway photo

◄ MOST of our peppers are grown in California and Florida. Here the harvesting is in progress at Sanford, Florida

▼ THE PUNGENT PODS that the American Indian gave the world have become a ten-million dollar crop in this country. The familiar green peppers are esteemed in salads and stews. Many different varieties are grown, two of which are seen here

Jack Manning photo from Black Star

South American Indians in warfare with the Spanish explorers. This is not difficult to believe, for Philip Miller, in his *Gardener's Dictionary* of 1768, wrote: "If the ripe pods of *Capsicum* [the pepper] are thrown into the fire, they will raise strong and noisome vapours, which occasion vehement sneezing and coughing and often vomiting, in those who are near the place, or in the room where they are burnt. Some persons have mixed the powder of the pods with snuff, to give to others for diversion; but where it is in quantity, there may be danger in using it, for it will occasion such violent fits of sneezing, as to break the blood-vessels of the head, as I have observed in some to whom it has been given."

Another story from the West Indies attesting to the pungency of some of the peppers has not been verified but is worth repeating. The natives there, it has been reported. test their pepper sauces by pouring a drop on the tablecloth. If the sauce doesn't eat a hole in the tablecloth, it is put aside as being too mild.

Cayenne pepper, red pepper, chili powder, and paprika are all prepared from the dried ripe pods of pepper. The first three are all definitely hot, ranging from a rather pleasant sensation to a fiery burn approaching the hinges of Hades, and are prepared by grinding the whole pod, seeds and all. Paprika is a milder spice, and in the preparation of the better-grade paprikas the seeds are first removed so as not to detract from the color. The best paprika comes from Hungary and is used mainly to add color to food. Professor Albert von Szent-Györgyi of Hungary won the Nobel Prize in 1937 for his discovery that paprika is rich in Vitamin C.

Chili con carne, or "pepper with meat," is a well-known Spanish-American dish which has been widely adopted in this country, although in the United States much less pepper is used in its preparation than in Mexico. Another Mexican pepper sauce, *mole,* contains three varieties of pepper, all hot, plus chocolate and eleven other ingredients. According to its enthusiastic advocates, its use can soothe the troubles of the world.

Among the pepper sauces, perhaps the best known in this country is Tabasco, named after a hot pepper that originally came from the state of Tabasco, Mexico. The history of the commercial development of this sauce dates from the middle of the last century. Following the Mexican War of 1846-48, seeds of an especially fine pepper were brought back from Mexico by a soldier and grown in Louisiana by Judge Avery and Mr. McIlhenny, a banker. After the Civil War, these

Charles M. Rick photo

▲ A BRANCH of the South American pepper, "rocoto" (*Capsicum pubescens*). The flowers of this species are purple, whereas those in our common garden peppers are white

▼ **PEPPERS BRIGHTEN THE GARDEN.** This is a variety of the common garden pepper (*Capsicum annuum*), in which the pods are borne in clusters. The red pods are especially decorative. But don't bite into one of them. Even touching the eyes after handling the pods can cause a burning sensation that will last several minutes

Charles D. Heiser, Jr., photo

gentlemen found themselves impoverished, and they experimented with the making of condiments and seasoning. One of the sauces made with the Tabasco pepper was especially flavorable, and friends persuaded Mr. McIlhenny to market the new sauce. Today its use is widespread. The pungent, highly aromatic qualities of this sauce are brought out by a special process. Most table sauces are cooked before bottling, but the Tabasco peppers are macerated after picking and packed in oaken cases without cooking. The macerated peppers are aged for three years, and the cured mash is then mixed with vinegar before bottling. Tabasco sauce is used to bring out the flavor of a great number of foods, and one person has even reported that it is good on ice cream.

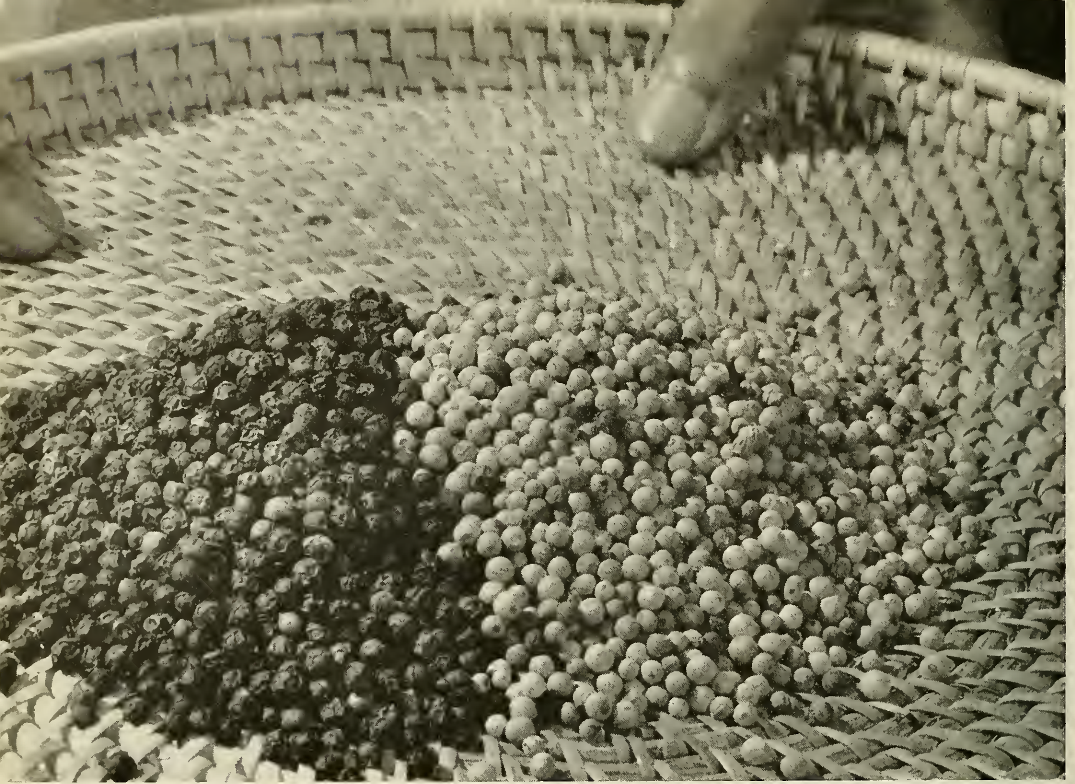
Today in this country the peppers —both hot and sweet—are a ten-million-dollar crop. They are widely grown, the greatest areas of production being centered in California and Florida. The sweet peppers or bell peppers are widely used in salads and for stuffing with meat. The peppers contain vitamin A as well as C, so that they constitute a nutritious as well as a tasty dish. The ease with which peppers can be grown and their relative freedom from insect and fungus diseases make them an ideal plant for the home gardener. The sweet varieties, California Wonder and World Beater, are particularly widely grown. For some reason, the large sweet varieties are referred to as "mangoes" in the Midwest, although the name "mango" is more properly applied to the fruit of a tropical Asiatic tree *(Mangifera indica).*

Another variety of sweet pepper, pimiento, is used in olive-stuffing and cheese. Here, too, the common name is somewhat ambiguous, for the term pimiento is also applied to allspice, which is derived from the fruits of a Central American tree *(Pimenta officinalis).* The confusion resulting from the use of the same common names for completely different plants is one of the many good reasons for scientific plant names, which can be used for one and only one plant. Another pepper often grown by the home gardener is the Banana Pepper or Hungarian Wax Pepper. This is a somewhat pungent variety, whose fruit changes from greenish-yellow to yellow to red. It is eaten in the yellow stage, and the color plus the shape has led to the name Banana Pepper. Some varieties of peppers are highly ornamental because of the beautiful and various colors of the fruit. These are occasionally seen in flower gardens and greenhouses. As a border plant for the flower garden, the variety Floral Gem and some of the other Celestial Peppers have few equals.

The red and green or chili peppers that we have been discussing all belong to a single genus of plants known botanically as *Capsicum*, and the active ingredient producing the pungency is a volatile alkaloid known as capsaicin. The peppers are closely related to the tomato and potato. Like these plants, peppers were introduced into Europe from America, and for some reason they were much more readily adopted as a food plant by the Europeans than either of their more important relatives. The name pepper itself—like mango and pimiento —is somewhat misapplied when it is used for *Capsicum*. The true peppers, the black and white peppers, come from a totally different plant, *Piper nigrum*, which is native to the oriental tropics. However, the use of the name "pepper" for American plants is not difficult to understand. The early Spanish explorers were interested in finding the spices of the Far East, and the red-hot pungency of the pods of the American plants led them to believe that they had found a new sort of pepper.

The use of the scientific name, *Capsicum*, for these plants is somewhat more difficult to understand. It has been suggested that this name comes from *capsa*, Latin for "box," because of the supposed boxlike shape of the pods of some of the peppers, or possibly from the Greek word *kaptō* meaning "to bite," alluding to the hot, pungent properties of these plants.

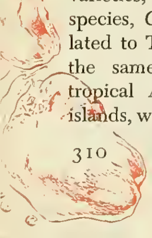
Over 100 varieties of peppers are known in North America alone. The



Courtesy Information Office, Republic of Indonesia

▲ UNKNOWN to the American Indians was black pepper (*Piper nigrum*), widely cultivated in the Far East. At left are the ripe fruits, or "peppercorns," that are the source of the black pepper of commerce. At right, fruits with the outer coats removed, used to prepare white pepper

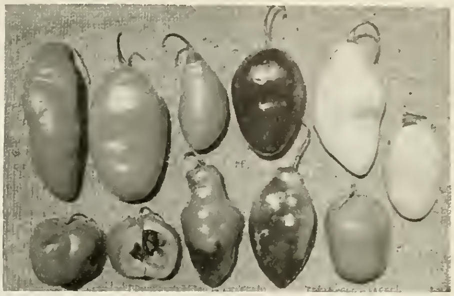
majority of which belong to the species *Capsicum annuum*. These varieties differ chiefly in the shape and size of the pods. Some of the hottest varieties are no larger than cherries, and some of the mildest varieties are as large as a tomato. At one time most of these varieties were called distinct species, but it has since been learned that the varieties hybridize freely with one another and produce fertile intermediates. However, so far none of the garden peppers belonging to *C. annuum* can cross readily with the variety Tabasco, and for this reason, and because the Tabasco plant differs slightly from all other varieties, it is placed in a separate species, *C. frutescens*. Peppers related to Tabasco and belonging to the same species are found in tropical America and the Pacific islands, where they apparently grow wild. How these plants got to the Pacific islands poses an intriguing problem. Some botanists maintain that some American plants were carried to the islands by voyagers in pre-Colombian times, whereas others just as stoutly hold to the idea that they were introduced into the Pacific by the Spanish. As there is some evidence in favor of a prehistoric transfer of at least one plant, the sweet potato, the distribution of others like the pepper warrant critical study.



How many other species of peppers there are is not known with certainty, but there are at least two other cultivated species—*C. pubescens* and *C. pendulum*—in Central and South America, which have long been grown by the Indians; and several wild species are also placed in this genus of plants. The wild ancestor of the cultivated species is not definitely known.

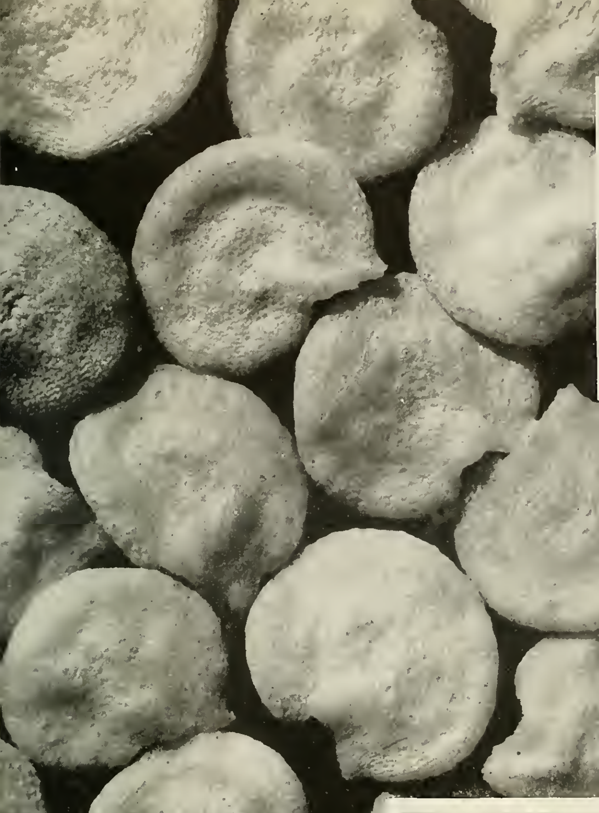
That the chili or *Capsicum* peppers are American in origin has, however, been established beyond much doubt by the presence of wild species in this hemisphere and by the fact that the peppers have been cultivated by the natives of America for a long period of time. Remains of pepper pods and seeds have been found in Peruvian graves that date from more than 2000 years ago. The Indians of the Americas probably found the peppers a valuable supplement to their farinaceous diet of corn, beans, and potatoes. They are still extensively used by the Indians of Central and South America—the hotter the better. Not only are peppers used in cooking, but the children are reported to eat the small pungent varieties the way we would eat peanuts.

How the Indians brought the



Charles M. Rick photo

▲ SOME IDEA of the great variation in peppers can be seen in the pods of the South American pepper, rocoto (*Capsicum pubescens*). The fruits also vary in color—red, orange, yellow, and brown



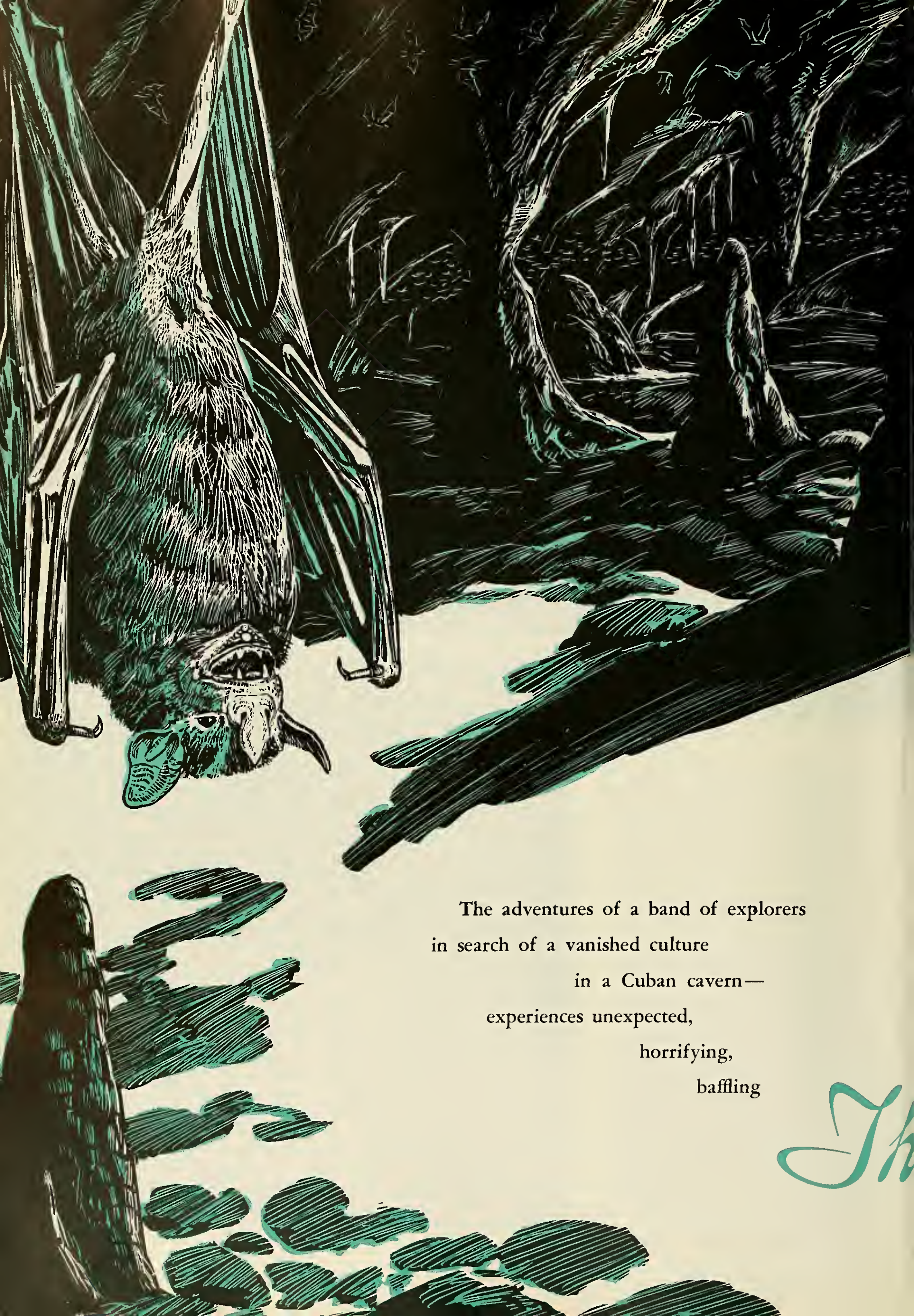
William D. Barkley photo

◀ SEEDS of a pepper, highly enlarged

▼ CHILI PEPPERS drying in the sun: a familiar ornament of the patio in Mexico and our own Southwest

George W. Thompson photo

peppers under domestication is, no doubt, an interesting story, but at present we do not even know where or when this occurred. We can narrow it down to Central or South America, and it is not improbable, of course, that different species were brought into cultivation in both areas. The problems involved in tracing the origins and diffusions of our cultivated plants are exceedingly difficult. They provide fascinating research, however, and are of great importance not only to the botanist but to the anthropologist, who can use the information gained from the study of cultivated plants in piecing together the early history of man. Studies on the peppers, now under way by Dr. Paul Smith of the University of California, may eventually help fit together some of the pieces of this complicated puzzle.



The adventures of a band of explorers
in search of a vanished culture
in a Cuban cavern—
experiences unexpected,
horrifying,
baffling

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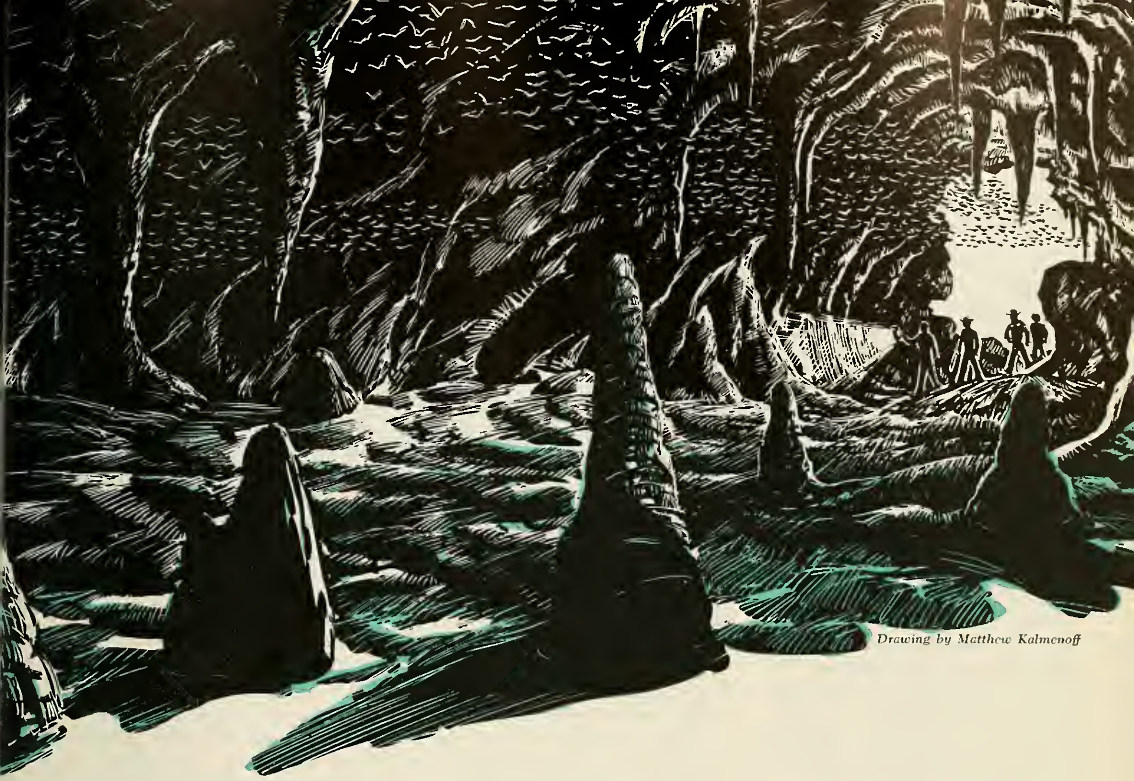


Drawing by Matthew Kalmenoff

Idol of the Cave

By M. R. Harrington

Curator, Southwest Museum,
Los Angeles, California

"PEOPLE tell me, señor, that you have discovered a cave at La Patana in which you found hairy spiders knee-deep. Is that a fact?"

I had to inform the gentleman that he should not trust back-country gossip, especially the brand current about Cape Maisí. The term he used, *arañas peludas*, strictly interpreted "spiders hairy," in Cuba refers to tarantulas. We did not find tarantulas knee-deep in the cave he had in mind, but what we did encounter was almost as extraordinary and unexpected.

My first intimation that such a cave existed came some time before, while my archaeological expedition, sent out by the Museum of the American Indian, Heye Foundation, was quartered at the little village of Jauco on the south coast of Cuba, some distance west of Maisí. Well I remember the evening when a gaunt young Cuban, his once-white suit smeared with the red clay of the hills, arrived from La Patana, bearing a mysterious bundle swathed in cotton sheeting.

Opened, it disclosed a number of little human and animal figures made of pottery, which seemed to be handles broken from bowls, and several polished-stone hatchet blades that were very well made. Finally, there was a beautifully finished wooden platter with carved decoration and a grotesque head on one end for a handle. It was of ancient Indian make but unlike anything I had ever seen. We were amazed, because our own digging thus far in Cuba had produced only very crude implements of shell and stone.

"From a cave near my home," the young man explained. I knew the platter must have come from a cave, and a very dry one at that, or it never could have survived the centuries. "My family, the Mosqueras, own the place."

"There are other caves at La Patana," he went on, "some very dark and very large, that we fear to enter. Strange sounds are heard within them, and the air has a sickening smell. In one, they say, there is a *zemí,* an idol of stone worshipped by the Indians long ago; and the grandfathers tell us that the monster serpent of Maisí, *la Culebra Serpiente,* dwells somewhere within them."

I had heard yarns of the "Snake Serpent," and I might have thought they contained a grain of truth if the storytellers had not always insisted that the creature "crows like a rooster." That was too much to swallow. The story of the idol might be a fairy tale, too; but if it really existed—and we could find it—it would be a prize for the Museum. At any rate, the caves of La Patana should be explored.

Our visitor explained that the name La Patana referred to a wooded terrace—he called it a mesa—on the south flank of the great limestone plateau that forms the eastern tip of Cuba. There were five or six such terraces, he said, forming giant steps from the flat summit down to the sea. La Patana, named from the Patana cactus, lay about halfway down.

Finally, our work at Jauco was finished. By this time we had discovered why the first specimens our excavations uncovered were so much cruder than the fine articles from La Patana: they had been made by a different people—an earlier, more primitive tribe, who had preceded the more advanced Taino Indians found by Columbus in eastern Cuba.

The early people, whom we called "Ciboney," apparently raised no crops but lived entirely on the natural products of the forest and the ocean—mainly the former, to judge by the great number of land-snail shells and land-crab claws they left behind in their ash dumps. In place of pottery, they made bowls and dippers of large conch shells with the insides removed, and conch shell instead of stone was their material for hatchet blades and gouges. How long they lived in Cuba we have no way of telling; but the bones of a large extinct animal, the ground sloth (*Megalocnus*), are sometimes found in Ciboney cave deposits, and this suggests a long time.

After them came the Tainos, an agricultural people, growers especially of *yuca,* or cassava, and of corn. In fact, our word "maize," applied to Indian corn, comes from the Taino language. They were skilled potters and loved to decorate their work with little figures of men and animals, modeled in the round. Their ax heads were of stone, often beautifully shaped and highly polished. Their wood carving was excellent, and they were skilled in making ornaments and little charm statuettes in shell, bone, and stone. The things brought to us from La Patana were undoubtedly Taino products.

So it was with high expectations that we moved our headquarters eastward to the Finca Sitges, an extensive coffee and banana plantation on top of the plateau, owned by the hospitable Don Antonio Rey. By this time our party had received a welcome addition—a representative of the Cuban Government, Dr. Victor J. Rodriguez, who was a zoologist from the University of Havana. Of course, La Patana was one of our first projects.

Following a narrow trail and burdened with packs of food, hammocks, and blankets, we climbed down over limestone cliffs and crossed stretches of orchid-hung tropical forest. Finally, once more descending, we sighted the palm-thatched roofs, beehives, and broad-leaved plantain trees that told of human habitation. In a few minutes we were talking with the elder Mosquera, father of the young man who had visited us. He assured us that we could explore the caves to our heart's content. They used only one, which contained the spring from which they drew their water.

I asked him why they had no trail for saddle or pack animals. I was amazed at his reply: "It is not necessary," he said. "We raise most of our own food here. If we need anything from the store, we trade honey and beeswax for it, and that can be carried easily on foot. If money is needed, the boys go up and work on the *fincas.*"

He detailed one of the "boys"—his son Cecilio—to show us around. Depositing our packs and taking only trowels, camera, carbide lights, and a lantern, we set out.

First he led us along a well-beaten trail to the Cueva del Agua, water supply for the Mosqueras. Passing through the high-arched entrance of the cave, where stalagmites stood looking from a distance like groups of statuary, we soon reached the crystal-clear spring. It lay at the very back yet was still in plain daylight. We searched and searched but found little trace of ancient Indians, except for a few bits of pottery at the very entrance. Then we followed Cecilio to the fateful passageway leading back into the mountain, which we had not noticed before.

"Where it leads I do not know," he said. "We have never dared to follow it. But you have good lights; with you I am not afraid."

With some trepidation we set out. The passage dipped slightly downward, turning to the west. We had just begun to feel a little more at ease, when suddenly it ended—in

▲ Within the mouth of Cueva del Agua—a fit setting for the dark adventures the explorers encountered

a great black gulf. We saw this just in time.

We approached the edge cautiously and shone our lights into it. Apparently the chasm had neither end, top, nor bottom. It was Rodriguez who thought of dropping a loose stone into the abyss. After an interval, we heard it ring on the bottom. "It does have a bottom after all," he remarked with a wry grin.

As we stood, a few bats fluttered out of the darkness, wheeled about our heads, and disappeared again. Opening his kit, Rodriguez produced a butterfly net, hoping to catch new species of bats. We turned our lights down so as not to scare the creatures, and it was while Rodriguez was trying to net one that we first noticed the peculiar acrid odor wafting up from the depths.

And then we heard it—a strange, unearthly, roaring sound, which grew louder and louder. We all stepped hastily back from the brink. Gaspar Leiba, one of my helpers, half drew his machete. Bats were forgotten.

We looked at each other in amazement. Now the sound gradually dwindled away until it was nothing but a low murmur. I found my voice first.

"What in heaven's name is *that?* I've explored a lot of caves, some right here in Cuba, but I never heard anything like it." Of course, it couldn't be the *Culebra Serpiente,* or could it? The idea was not pleasant. Also, I am ashamed to say, I thought of the ground sloth, a large extinct animal whose bones we had unearthed in another cavern. Could monster serpents or ground sloths roar?

"I can't understand it," Rodriguez said. "It couldn't be a waterfall deep underground, because the noise is not continuous. It might be surf in a sea cave, only we are too high above the ocean and too far back . . . Listen!" the roar was beginning again.

This time we stood our ground, peering over the brink, but no monsters appeared. All was black darkness as before, but we noticed for the first time a faint glimmer of daylight, distant and far below.

"See that light?" Cecilio asked. "I think that is another entrance, and perhaps I can lead you to it. I went in one day when I was a boy, but something roared at me and I came out flying."

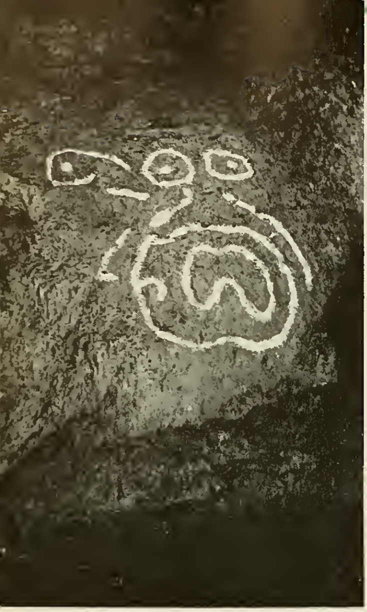
He led us out of the cave, down a cliff, and around a projecting point of the mountain. There, along its base, stretched a great hole, open to the sky and perhaps fifteen feet deep. Fortunately, a large *jaguey* tree grew in the near end, and this we used as a ladder to clamber down. There were two cave mouths running from the hole back into the mountain.

Cecilio picked the easternmost, and in a few minutes we found ourselves in a huge dark chamber. The smell was stronger than before, and again we heard mysterious murmurs and roars. The sounds seemed to come from a passageway blocked with fallen limestone on the west side of the cavern. However, to be sure we were on the right track, I sent Gaspar with a lantern to retrace our steps. Sure enough, after an interval we saw his light emerge high above us on the opposite wall.

After his return we tried to enter the blocked passage but could not get through. Then Cecilio suggested that the other cave mouth might tap the same passage on the other side of the rockfall. He was right.

The smell here was much stronger, and the roaring, when it came, louder still. And what a sight lay before us! The floor of the passage, as far as we could see, was carpeted with living, moving cockroaches. Rodriguez, who wore no

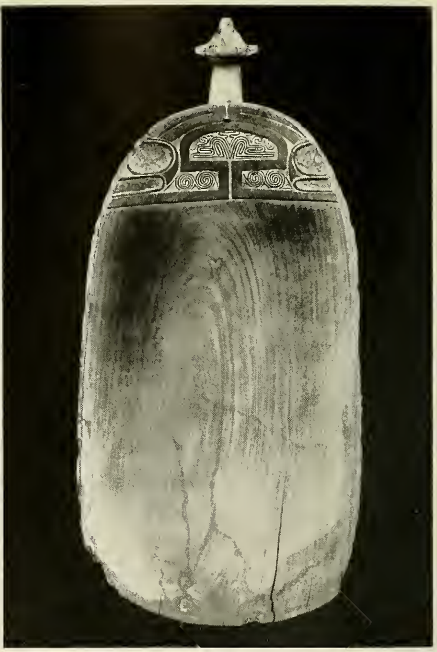
◀ The idol in the cave. It stood 50 feet inside, but every morning a shaft of sunlight struck it full in the face



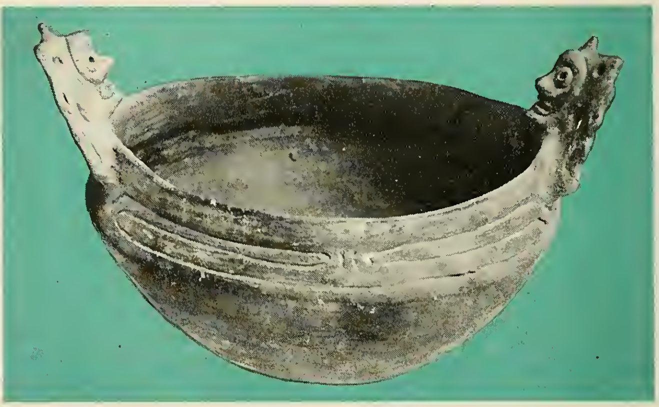
▲ A ROCK CARVING in Zemí Cave

All photographs courtesy of the Museum of the American Indian, Heye Foundation

➤ CARVED WOODEN PLATTER found in one of the caves: a product of the vanished Taino Indians



▼ POTTERY BOWL, with human head handles, made by the Taino Indians near Cape Maisí, Cuba



leggings, kept his legs moving to prevent the repulsive creatures from crawling up his trousers. And every now and then we saw a big shiny centipede winding solemnly along. One, I noticed, had a cockroach in its mouth.

We started walking along the passage, crunching cockroaches at every step. Now the air grew hotter, the roars were louder, the smell was almost overpowering. Bats fluttered overhead. Soon there appeared an added horror; the walls were now decorated with huge, black, spider-like creatures. We later identified them as a species of tailless whip scorpion, with one pair of legs lengthened for use as feelers in the darkness; but at the time, they looked like big black spiders to us.

As we went on, it grew still hotter and more oppressive; the lights flickered, and the kerosene lantern went out. We might have continued, even so, but for one thing. I spied a mound of fighting, struggling cockroaches and kicked them aside to see what they were after. It was a baby bat, already half picked to a skeleton, although the poor creature was still moving a little.

What would happen to *me* if I were overcome by the bad air in that awful place? Already I felt a little dizzy. The same idea must have struck us all at the same moment, for we turned and beat a retreat without a word. I remember we looked back nervously whenever the roar increased, half expecting to see—what?

Climbing back up the cliff, we drew a couple of buckets of water from the spring and washed up. Then, after retrieving our packs, we hung our hammocks for the night from trees near the Cueva del Agua. The Mosqueras had invited us to stay with them, but we politely refused. We were too tired and frustrated and did not even enjoy our supper. It did not improve my own state of mind to realize that we had not seen a trace of ancient Indians since we picked up those bits of pottery. Where was the Idol of Cape Maisí?

As night approached, we noticed a black cloud of bats emerging from the cave mouth, setting forth on their nightly search for food. To check on what might be happening at the last cave we had visited, we made our way down the cliff again. What a spectacle! Here they were pouring out in swarms. It seemed to Rodriguez that there were different species and that the bats emerged in groups, the same kind flying together.

After about an hour, we returned to our hammocks; but the bats were still coming—fluttering black blotches against a fading sky.

Rodriguez came over and sat on the ground beside my hammock. "You know," he said, "I think the heat and the bad air in that cave are due mainly to bats. As you saw this evening, there are an enormous number of them. While they are out hunting food at night the cave should cool off, and maybe they sweep in a little fresh air when they return at dawn. If we try again early in the morning, perhaps we can get somewhere."

It was so agreed. Rising at daybreak, we gulped down our coffee and hardtack. As a matter of precaution, I belted on my .38. I can still picture my little force: Rodriguez, brown-eyed, pale-faced, rather frail of body but determined in spirit, and armed with a collecting pistol; Juan Guache, my *ayudante*, of pure Spanish ancestry, hook-nosed, thin-faced, and as blue-eyed as they come. He carried a machete, as did the other two, who showed plainly their Cuban Indian blood —short but well-built Gaspar Leiba and lanky Cecilio Mosquera. As an extra piece of equipment, Gaspar carried a large canvas bag, to use if we found something worth collecting.

Soon we were again treading the cockroach corridor. Rodriguez was right. The air was distinctly cooler, much more breathable; the lights burned steadily. Even the odor seemed less pungent. But the roaring—that was as loud and frightening as before. We passed the place where we had turned back previously, and pressed on and on. Suddenly an unusually loud roar halted us in our tracks. I confess I grabbed for my gun. All at once the air seemed hotter again, more stifling. The temptation to turn back was strong.

But the sound died away, and we forced ourselves to go on. Soon we were standing on the threshold of another great chamber. We shone our lights about. Wherever we looked, the high vaulted ceiling was covered with clinging bats! Besides these thousands there were hundreds more fluttering about, looking for a place to alight.

"Listen!" Rodriguez whispered.

A murmuring sound was plainly audible. One bat is silent enough, but hundreds of them, in that confined space. . . . There was no doubt about it; the murmur was the sound of their wings, reverberating from the vaulted roof.

"I'm going to try something," he continued. "Watch this!"

"HOLA!" he shouted.

Instantly every bat in the cave took wing; the murmur rose to a roar!

We stood there, dumbfounded. Gradually the sound decreased as the frightened creatures returned to their places.

We had solved our major problem—and a minor problem as a result: the infernal smell in the cave. It was "the concentrated perfume of bats," as Rodriguez phrased it. The floor of the cave was composed mostly of bat droppings, the accumulation of nobody knows how many years.

A more difficult question was the cockroaches. What did they live on? It seemed improbable that there were enough fallen baby bats or dead adults to keep them alive. It seemed likely that they found pieces of bugs in the droppings of the insect-eating bats, and Rodriguez offered a further possibility. Scooping up a handful of bat guano from the floor, he said:

"Do you see all these rough-looking little sticks mixed in with the droppings? I think they are *jubo* berry cores." (These berries grow on trees and have fibrous cores something like American mulberries.) "Many of the bats are fruit eaters," he continued. "Perhaps they bring back berries to chew on; the cores drop to the cave floor, and the little *cucarachas* suck the remaining juice." In any event, the cores got into the cave somehow, and the roaches must have enjoyed them.

On our way back along the cockroach corridor, I walked close to the right-hand wall, looking into holes and cracks where the ancient Indians might have stowed away something of interest, as indeed they had hidden the wooden platter. Coming to a larger crevice, I peered in and found myself face to face with—a big snake neatly coiled in the opening, its nose not ten inches from mine! Jumping back, I called Rodriguez. He investigated cautiously.

"It's what we call a *majá*," he said, "a relative of the boa constrictor. I'm going to try to catch it for the zoo in the Parque Colon at Havana. Don't worry, it's not poisonous. In fact, we have no poisonous snakes in Cuba."

He waved his left hand in front of the hole while Juan shone his light upon it; he kept his right hand at one side, out of sight. I saw the snake raise itself, watch for a moment, then stick its head out of the crevice to see at close range what was going on.

Instantly Rodriguez grabbed it by the neck, and the struggle began. After some minutes, seeing that my friend could not make it alone, I took hold also. How long we pulled and sweated, I don't know. Sometimes we had the snake nearly out of the hole; then, in a panicky burst of strength, it nearly got away from us again.

Finally Rodriguez had an inspiration. Calling Gaspar, who was still carrying the canvas sack, we slipped the snake's head inside it, then turned the reptile loose. Apparently content to find peace and quiet in the sack after so much commotion, the reptile let go with its tail and of its own accord slid its eight feet of length into the receptacle. Rodriguez tied up the sack, and that was that.

As we headed again for the entrance, a loud roar from behind startled us. We knew now what it was, yet, instinctively quickened our pace. In fact, we were almost running when we emerged into daylight.

Once in the cool cave mouth, we sat down to recuperate. Gaspar,

Continued on page 335

gingerly depositing the snake bag on a smooth spot, announced, "Now, with permission of the señores, I shall bathe myself." He shed his cotton coat and trousers, kicked off his *alpargata* shoes, and stepped into a pool of water on the east side of the opening.

The rest of us, equally sweaty and dirty but less ambitious, watched him with envy. Suddenly I noticed, on the cave wall beyond the pool, something unusual. The whole surface was covered with ancient Indian carvings, known to archaeologists as "petroglyphs." They were in plain daylight, although partially hidden by an encrustation.

Now, with renewed interest, I looked about the cave mouth for further traces of ancient Indians. Not fifteen feet away, I was astonished to find that a large stalagmite we had passed several times on our way into the cave was crudely carved to represent a human figure! It not only had a plainly marked face but indications of a body carved upon it. It was the *Zemí*, idol of Cape Maisí.

The stalagmite, about 4 feet high, stood some 50 feet back from the shelter line of the cave mouth, in plain if subdued sunlight. Most of the carving was on the surface of the stalagmite that faced east. Here we found a plainly marked face made by pecked-in grooves clearly representing the mouth, nose, and eyes. Other grooves suggested limbs and male genitals, and still another encircled the forehead like a headband. This image was so placed by nature that at a certain time in the morning, at least during our stay in June and July, a shaft of sunlight striking through a crevice fell full upon the face of the figure for a few minutes.

The north, south, and west surfaces also bore rude faces indicated by shallow depressions, but these were less detailed than the east face. In order to photograph the north face, for example, we had to whiten the grooves with cassava starch.

Who made the idol? We consider it a product of the Taino Indians, who had carved the beautiful wooden platter, but the workmanship is crude for such skillful craftsmen. Perhaps it dates back to the days of the Ciboney tribe—the much more primitive people who occupied eastern Cuba before the Tainos.

It seems probable that the mysterics of the hot, dark, subterranean chambers—the roaring sound, the millions of cockroaches, and thousands of bats—existed in Indian days as well as now. If so, these awe-inspiring phenomena may well have caused the selection of this particular cave as a special spot for "cavern worship," known to have existed also among the related Indians of Haiti.

But alas for my dream of finding a real prize for the Museum! I had pictured a statue of stone or wood that could be picked up and carried. The idol, being a stalagmite, was anchored to the rock bottom of the cave! Moreover, it must weigh 400 or 500 pounds—far too heavy for any pack animal to carry, even if we could pry it loose. And if we succeeded in finding a strong enough pack animal, there was still no trail from La Patana to the outside world.

All I could do was to photograph the idol and the carvings; and when we returned to Finca Sitges, I mentioned them in my routine report mailed to the Museum. Regretfully, I thought that was the end of the matter.

But I was wrong. Coming in from a trip one day, I found a cable from Dr. Heye, the Director. "GET THAT IDOL" was all that it said.

Plainly, a trail was the first necessity, so we went scouting and found that to build one up the cliffs was out of the question; it would take too long. Our only hope would be to follow the terrace of La Patana eastward and connect with the old trail leading from the top of the plateau to the lighthouse at Cape Maisí. That would take only days, not weeks. So we got busy rolling rocks aside and where necessary cutting a path through tropical growth with machetes. In one place, where the limestone underfoot was full of holes and

Continued on page 335

Chrysa

By Woody Williams

HAVE you ever reached out for a flower, only to have it vanish as if touched by magic? Well, try to take hold of *Eudistylia*. However, botanists need not search their check lists for this unfamiliar name, for *Eudistylia* is not a plant.

I found it when wading in the shallow waters of a California bay. The bottom was carpeted with broad fronds of bright green sea lettuce. Among this growth were gay "chrysanthemums"—some orange, some maroon with orange bands. I knew that many things in the sea are not as they seem. Seaweeds twist over the surface to suggest serpents. The coral gardens of the tropics are not gardens at all but teeming menageries. These creatures, extending from the sandy mud of a shallow bay, certainly appeared to be escapes from some autumn garden. But how could they live beneath the sea?

I shuffled toward one and bent down to take it in my hand, but I came up with only a piece of sea lettuce. I pushed toward another, the sun behind my back. This time the flower head vanished before I had come even within reach. These chrysanthemums in the sea were a lie. Did they exist at all, or was I a victim of my imagination?

Meanwhile, the tide receded. Among the limp sea lettuce on the sticky bottom, I saw some tubes projecting above the surface. A bit of color dripped dejectedly from one tube, but as I approached, it slid out of sight. This, then, must be my flower. And I resolved to dig it out with a shovel.

Blisters developed on my hands, and yet the tube went down and down, curving here and there to circumvent a rock. The hole I had

hemum of the Sea

A flower that moves or an animal whose head is a blossom? This perplexing creature looked liked a fugitive from an autumn garden, but it lives its curious life in a California bay

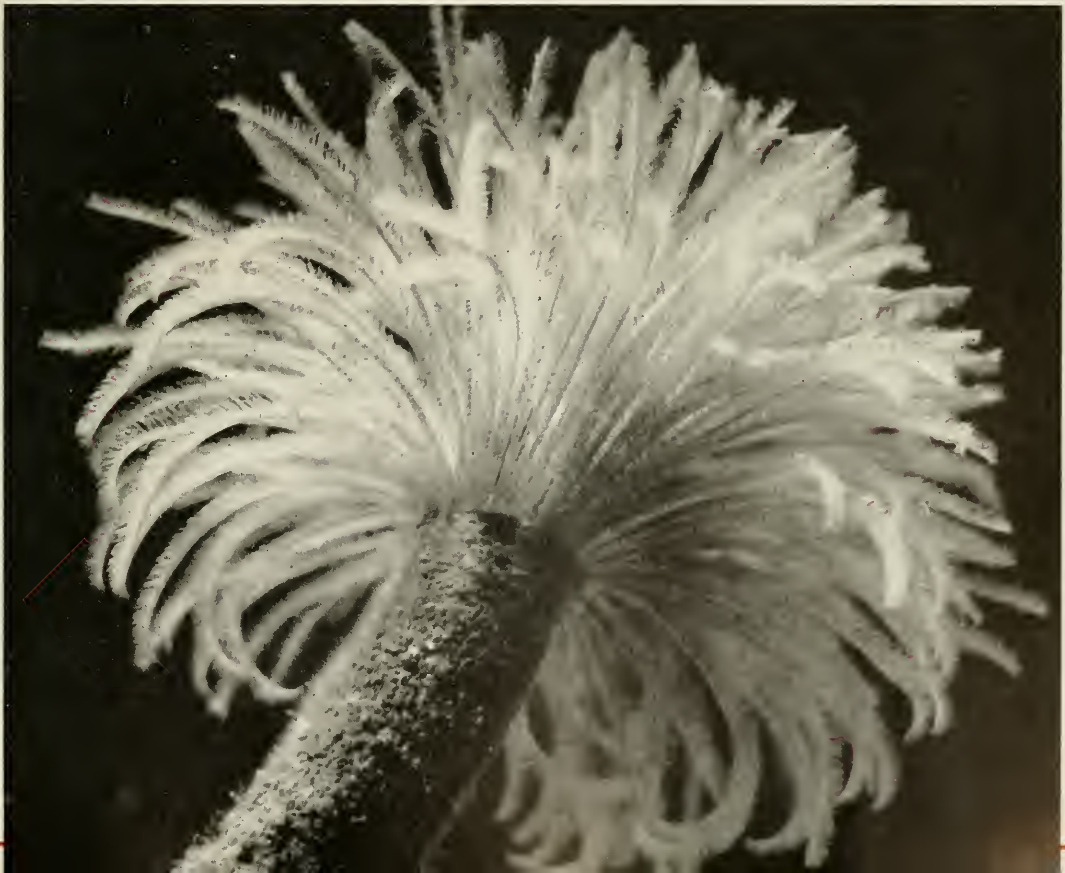
dug finally extended to arm's length and beyond. Still the tube descended endlessly. In exhausted desperation, I tugged with all my might. It gave, and I sat down in the mud. In my hand was a parchment-like tube with a broken end. Its full length would have been about three feet. And hanging from it was the broken body of a worm as thick as my forefinger.

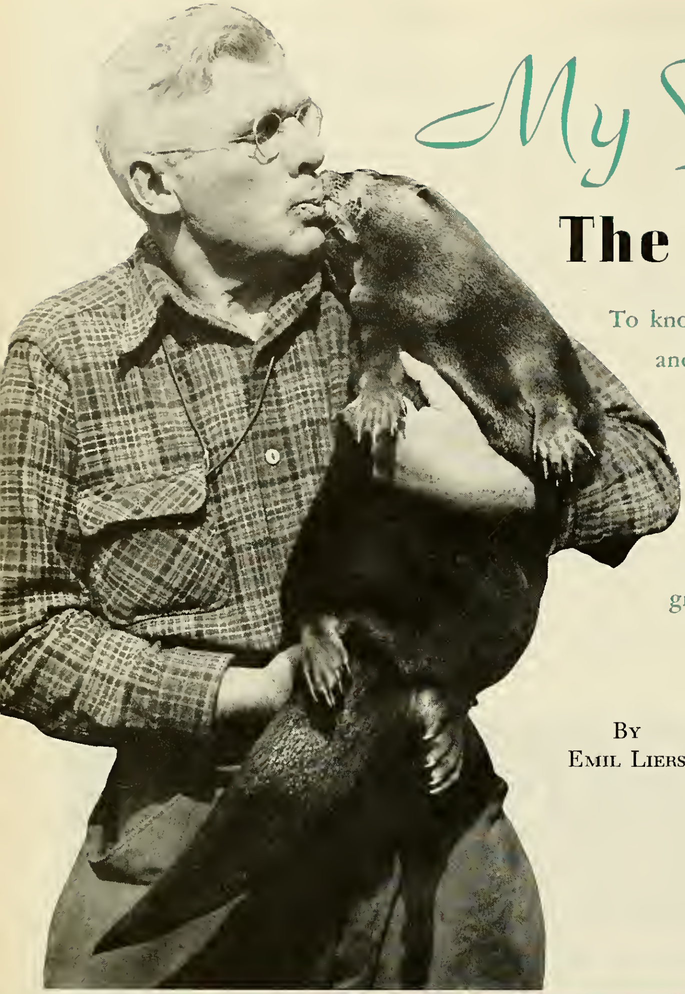
The animal slipped out of the tube, and there was my flower! When placed in a jar of sea water, it soon extended again into its former glory. The shape well suggested the local name, "Feather Duster." The worm did not seem greatly to mind the loss of over half of its length, which might have totaled two feet.

This creature was jointed like a "clam worm" or even an earthworm. On the side of each joint were appendages called "parapodia," with which the Feather Duster managed to propel itself up and down in the tube.

Numerous dots covered the tentacles of this gigantic worm, as if pepper had been sprayed over the head. Further examination revealed that these dots were simple eyes—the secret of the Feather Duster's disappearing act. These eyes were the worm's warning system, so that it could flash out of sight at the approach of a mere shadow.

The next time I meet a friend who hasn't seen anything extraordinary for a time, I will take him to a mud flat where *Eudistylia* lives. He will then see some of the strangest sights there are to see, and he will discover that even a worm has learned to lift its head nobly above the muck of a California bay.





My Friends
The Land Otters

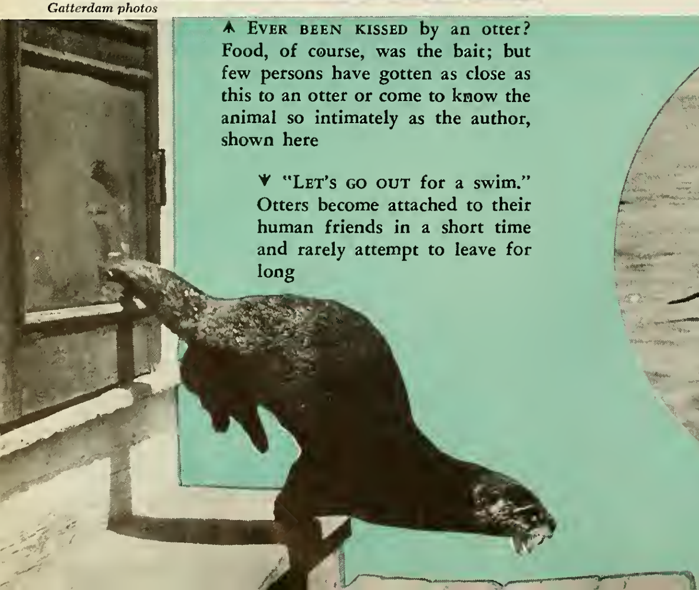
To know the land otter is to love him—and also to condemn the persecution that has all but eliminated him from the American scene. At least that is what the Liers have found since, quite by chance, they started a rapidly growing land otter colony in 1928

By
Emil Liers

IN 1928, two young land otters (*Lutra canadensis*) came into my possession, and before long my wife and I became so fascinated with them that we undertook to obtain more otters as pets in order to study and to try to raise them. Since then we have had about 150 animals of all ages, as many as 35 on hand at one time. We have had 29 babies born in our colony, in-

Gatterdam photos

▲ Ever been kissed by an otter? Food, of course, was the bait; but few persons have gotten as close as this to an otter or come to know the animal so intimately as the author, shown here



▼ "Let's go out for a swim." Otters become attached to their human friends in a short time and rarely attempt to leave for long

▲ In full stride, the land otter becomes a rhythmic undulation of curves cluding those of the second generation. We have found the otter invariably intelligent, generally cooperative and friendly, and always fascinating.

At our home near Homer, Minnesota, on the bank of the Mississippi, we have wire enclosures with wooden den boxes. I travel about the United States taking otters to schools, sportsmen's gatherings, and science meetings, where I tell what I have learned about them and let the otters visit with the people. I also take them to streams and lakes where they can swim, hunt, and have a good time. They have been extensively photographed, in both stills and movies, and have entertained and instructed many thousands of people. In working and living in such intimate contact with them, I think we have had a better opportunity to become acquainted with otters than any other living persons.

Otters have always been blamed for killing a lot of fish; and we naturally started out with the belief that our animals would eat mainly fish. But when we fed them fish, we had many sick otters and lost some. Finally, after many unhappy experiences, we found to our surprise that very few otters can survive on a diet of fish. Doctors and others doing research on diets, both among our otters and elsewhere, have confirmed this fact.

We found that the favorite and principal food of otters is crayfish, which feed extensively on young fishes. Thus, instead of being destroyers of fish, otters actually help to protect them. When an otter occasionally takes a fish, it is usually one of the sluggish kind that are rarely or never used by people, and some of these fish themselves devour young fish. Karl F. Lagler and Burton T. Ostenson, in a study of the food eaten by otters taken during trapping operations late in March and early in April, showed that the animals had eaten some game and panfishes, small fish such as minnows, mud minnows, and sticklebacks, frogs, salamanders, crayfish, insects, and some miscellaneous vertebrate material such as hawks and a goldeneye duck that had probably been picked up dead[1]. Since this study was made under late winter conditions, when crayfish and frogs are very scarce, the proportion of fish is probably far higher than the average for the year. Our own observations show that, in addition to crayfish and frogs, they eat snakes, turtles, mussels, snails, insects, worms, and some fruit and vegetable material such as roots, tender shoots, pond weeds, and algae.

My otters kill snakes that we meet along the streams and lakes. When they find a big snake, they chatter, call for help, and circle warily until the snake strikes several times. Then they kill it by biting the head. If hungry, they eat many of the snakes they kill.

Gatterdam photo

▲ THE AUTHOR allows his otters to swim freely in the Mississippi and other streams. One went astray for eleven days but was glad to get back home

◄ LAND OTTERS care far less for fish than they do for crayfish, frogs, salamanders, insects, etc. Thus the bad reputation they have among anglers is quite undeserved

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[1] "Early Spring Food of the Otter in Michigan," by Karl F. Lagler and Burton T. Ostenson, *Journal of Wildlife Management,* Vol. 6, No. 3, July 1942, pp. 244-254.

We have found that they thrive in captivity on a diet of 74% horsemeat, ½% liver, 8% bran, 10% raw rolled oats, 2% bone meal, 1 ounce brewer's yeast per day per ten otters, ½% tomato, lemon, orange juice or ½% of raw grated carrots, and one teaspoonful cod liver oil daily per otter. We add enough whole liquid milk to this to make a soft mash.

Sick otters, if taken in time, can often be saved with this diet.

Females that have just given birth are fed abundantly every three hours. For the first feeding, I put more whole milk in the mash and add 10% Pablum. Three hours later, I give the animal four ounces of calf or beef liver. Then comes a feeding of bread and milk; and in another three hours, raw meat. Next, I give the otter a tidbit, like frogs and crayfish. Later, as a nightcap around 9:00 P.M., comes a regular heavy mixture with Pablum and milk and 2% bone meal.

As might be anticipated with animals so very active, otters have big appetites and rapid digestion. Crayfish are digested and eliminated in about one hour.

Unfortunately, the false idea that otters destroy large numbers of fish has given them a bad name and deprived them of the proper protection. Hunting by sportsmen and the excessive trapping of otters for their fur have exterminated these valuable animals totally over large parts of their range, and only a few remain in the less settled regions. There are probably not more than 2000 otters in the United States. In Canada and Alaska their value as fur bearers is recognized, and small populations of otters have consequently been preserved, but not nearly as many as there should be.

Otters tame readily and after a short time become so attached to their human friends and their new home that they make no attempt to leave, even when the gates to their pens are left open. I freely take them for outings in the Mississippi River and other streams and lakes. Occasionally one strays away, and they have been gone for as long as eleven days. However, they seem to be very glad to rejoin me, and all I usually have to do is to keep searching or waiting in the vicinity of the streams and ponds, and sooner or later we meet. My whistling and calling causes them to return to me voluntarily, and usually they make such a display of affection that I know they are glad to be back with me and their other playmates.

Both young and adult otters are very active and playful. They are always ready for a romp with others of their kind, or with a dog or other animal acquaintance, or a human friend. While they are powerful and able to inflict serious bites, they rarely do so, and they use care not to injure a friend even though appearing to be in deadly earnest in a scuffle. Adults playing with young give them vigorous exercise but never appear to hurt them. Similarly, in playing with human friends, they may inflict hard pinches and even minor injuries, but these are never the result of unprovoked viciousness. However, when a mother otter is trying to keep a person away from her young, beware. She

⮝ THE TAME OTTERS ARE QUITE ready to be friendly with a dog or a racoon

⮞ BEGGING FOR tidbits at the table

is powerful and capable of inflicting severe bites and will not hesitate to do so if she thinks it necessary to defend the babies.

Mother otters are excellent parents. When the babies are small, the mother curls her body into a perfect "doughnut," enclosing the little ones so they are protected from the cold and can nurse. If mild danger threatens, mother otter places her head over the hole in the doughnut in which the babies are lying, thus completely hiding and protecting them.

The newborn babies do not open their eyes until the 25th to 35th day. At 85 days, I have had otter babies out with their mother at ponds and streams, and the little ones had grand times playing about on the bank, but they would not go into the water. Mother would catch a crayfish and bring it to them and would roll and play with them. When they are about 100 days old, mother acts as though the youngsters should begin to enter into real otter life. She tries to coax them into the water; and if they do not go in, she catches them by the back of the neck and drags them. After a few such introductions, they become enthusiastic swimmers and make short dives. Even when the babies are older, the tamest mother otters I have will not permit me to play with their children. They growl at me, and if I disregard the hint and put my hand near the young, mother grabs me gently but firmly and forces my hand away. If I still don't take the hint, she bites hard and is ready to fight. If the children are away from her and approach me, or if I try to coax them to me, she calls and talks to them, plainly warning them to stay away from me. If they disobey and approach me or allow me to approach them, she punishes them when she gets to them by shaking and scolding them.

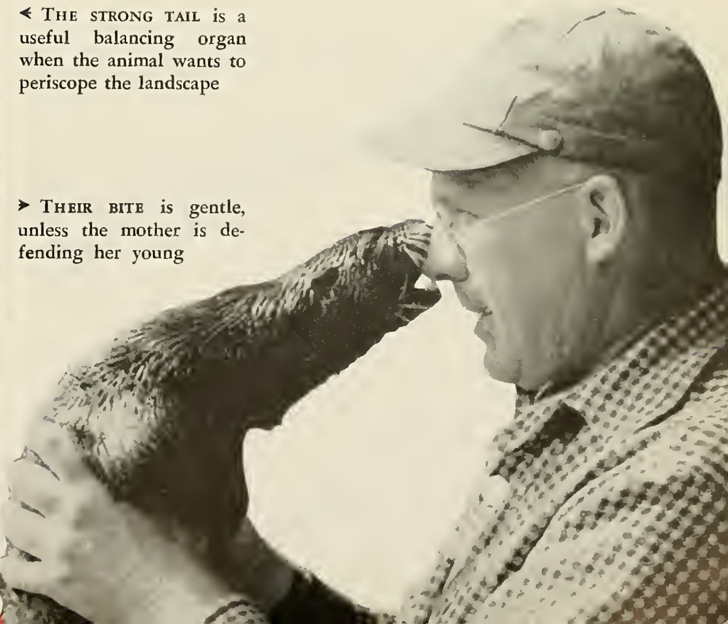
I do not believe that the male ever lives in the den with the mother and young, but he is near by most of the time. When the young ones come out of the nest, father often joins the family party, romping and playing with the babies and helping to teach them to swim.

Surprisingly little is known about the life history of this valuable and fascinating animal. Mating usually takes place in the water, and the gestation period, according to numerous observations I have made, may vary from nine months and eighteen days to twelve months and fifteen days. Perhaps this is not so surprising when we recall that the gestation period of mink, in the same family, ranges from 38 to 87 days and that of the marten from five to nine months. I am certain that otters breed every year after the second year. Mating takes place almost immediately after the young are born, as is the case with the fisher. In the northern states, the young are born in February, March, and April. Litters vary from one to four, usually two or three. One baby about a week or ten days old weighed six ounces, and ten days later she weighed sixteen ounces. They mature and are ready to breed when about two years of age. Full-grown otters range from about 16 to 50 pounds.

Tara, the first otter to breed in captivity, has produced four litters for me and is now seventeen years old. She shows no signs that her reproductive cycle is ended. This to me points to quite a long life for an otter—about the same apparently as a horse.

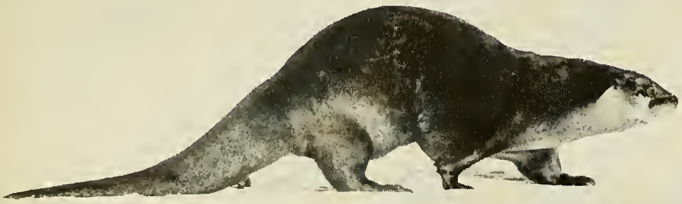
Otters are vigorous, healthy animals and in captivity have few ailments, except those that can be traced to improper feeding. Usually the mistake is to feed them too

◂ THE STRONG TAIL is a useful balancing organ when the animal wants to periscope the landscape



▸ THEIR BITE is gentle, unless the mother is defending her young

AN OTTER CROSSING the ice at a beaver dam. The otter will show interest in a uskrat or a beaver, but will not try to kill it



E. P. Walker photo

LAND OTTERS project their streamlined bodies through the snow as though it ere water. They wallow in the deep drifts with the same enjoyment that a young oy shows

THE GREATEST SPORT for an otter is to climb a steep snow bank and slide down with arms folded back against the body. But they never do this alone

Gatterdam photo

much fish or meat. With an excess of either, especially of fish, the animals apparently develop an acidic condition that often results in partial paralysis of the limbs, the loss of teeth, and very often death.

Unlike many other carnivores, otters get along with one another very well. I often have a dozen adults and large young in an enclosure or on an outing with me, and there is rarely any serious fighting. On the contrary, they have delightful times playing together, engaging in mock fights, swimming, diving, catching crayfish, frogs, snakes, and insects, and sliding down banks into the water or sliding on the snow or ice. They are always doing something, and it is always interesting.

Most of my otters enjoy riding in the automobile, and some like to go hunting so they can retrieve ducks or pheasants on either land or water.

The one sport in which both wild and captive otters seem to indulge most is sliding. It is a real treat to see them climb to the top of a slope—a steep stream bank or snow-covered hill—then head down, sliding on their under surface with their arms folded back against the body. The late Ernest Thompson Seton says, "Whether the otter slides from the top of a mere snowdrift into the adjoining hollow or down a muddy bank into a stream, or best of all down a long icy hill to plunge into deep, cool water below, it is evidently done for sport, for the joy . . . of flying through space without labor and without violence and with the very same exhilaration that such a thing would give to mankind. To this the creature fails not to add the crowning charms of good company and of friendly rivalry, for so far as I can learn, no one has ever yet seen an otter enjoying its slide alone."

Playing in the snow is grand sport for otters. They dive into it, travel through it, and emerge just as though it were water. They wallow in it with the same obvious enjoyment that boys and dogs show when playing in the snow.

➤ **Who is interested most,** the man or the otter?

Gatterdam photo

▼ **A fine foot** for swimming

Otters are friendly creatures and want to be friends with other animals—dogs, raccoons, cats, minks, even bears. It is fun to watch dogs and otters make friends. After a few meetings they are the best of friends, and they have a wonderful time playing together. Very seldom does a dog prove unfriendly toward an otter.

The otter is sociable. Bring a strange otter into the place, or a couple of cubs, and every otter is interested—male and female. They want to get acquainted with the babies—smell and roll them around. The little cubs lie supine as the old otter grunts and lopes away. The cubs follow, playing and chuckling their delight at finding a new mother or father as the case may be.

They are so very vigorous and have such a keen sense of enjoyment in activities that amusing incidents are endless. I could fill a whole issue of Natural History with otter lore, but a few incidents must suffice.

While making a "Sportlight" motion picture at Silver Springs, Florida, I took my otters and my Airedale into a large enclosure where a bear had denned up in a cypress bole. The cameraman was watching from a platform built outside the fence so he could look and shoot over the fence to film the picture, while the Director followed me with the Eyemo camera. We were all anxiously anticipating what would happen. The otters smelled around the big cypress, chattering to one another. Then they took a turn about the large yard, in one end of which was a long Cypress log over a muddy corner where the bear had wallowed in the mud. After that they went back to the bear's den in the cypress and chattered to each other. Then little Tetawish popped into a hole in the tree. The others quickly followed. No sooner had they entered than there was a "Woof!," and out popped the bear on the side facing the cameraman. With the otters following close behind, the bear ran on all fours, humped up, to the wallow and paced back and forth on the log. As the bear came to where the otters were below the log, first Jocho, then Tetawish reached up and nipped him on his paws. Every time they did that, he would raise his paw and shake it and run faster. The otters were having a lot of fun—not so, the bear. He jumped off the log and began to pace back and forth about the yard.

This all happened about as quickly as I can relate the story. I was thrilled, thinking of the interesting picture we had. I looked up at the cameraman, shouting, "We really got a picture that time."

But I was doomed to disappointment. He drawled back, "We have to do it over. I just watched to see what would happen. I didn't take any pictures."

That is what I mean when I say you have to rehearse everything for a Hollywood camera crew. There was a sequence worth thousands of dollars that went into thin air. A picture that will live forever in my memory—but not on the screen.

One day when we were on location, the photographer was busy grinding his movie camera when Jocho came up, grabbed his Zeiss still camera by the strap, and ran, dragging it into the pool of water with the photographer chasing her, laughing for all he was worth. Finally he caught up with her, but not until she had dragged the camera through the pool to the other side. I was surprised that he could consider it such a joke, but everyone loved Jocho. As he stood there laughing and looking at the damage done to the camera, Jocho swam back to the movie camera, grabbed his notebook, which was lying on the ground, and took it into the pool. So another chase was on to get the notes. We caught up with Jocho and captured the notes, a little the worse for wear.

One day I had a number of my otters out on the river front. They were busy swimming as I read under the shade of a tree. Soon several of them gathered around me, rubbing and drying and chattering away. I could tell by the talk that something was wrong. I called for the others but received no reply from four of them. Jocho and three cubs were missing. I called and searched—no Jocho.

Then someone called to me from the U. S. Fish Hatchery at Homer. They said Jocho and the cubs had come to visit them, much to the children's delight. The children had played a bit with Jocho and then placed all their attention on the cubs. Jocho did not mind that. While the children were busy playing, Jocho opened their screen door and went upstairs to the bathroom and took a bath in the toilet bowl. Then she went into the bedroom and dried off between the sheets of the bed. That was Jocho, just as playful at twelve years as she was at twelve months.

It was soon after I had begun taking my otters out to play in the streams that I learned they did not harm fish. But I often met fishermen who would scowl and otherwise show hostility. At first I did not guess why they were angry. Finally I found that fish protective officials had had wardens watching me with the view to filing charges against me when they saw my otters chasing and killing fish. But these same officers later admitted that in all their watching they had seen no evidence on which to base a case.

In eighteen years, even though I have had as many as sixteen otters in a stream at one time, I have only seen them catch three trout. Once, an otter plunged off a bank into a pool where there were several trout and came to the surface with one in his mouth. The second time, it was a crippled trout that was caught. The third fish was caught as the otters were swimming upstream. They came to a riffle. A brown trout of about a pound became frightened and swam up the riffle, hit a shelving rock, and skittered out on shore, where an otter caught it.

Otters occasionally catch a sucker or bullhead, but very few other fishes. They catch and eat many pollywogs, frogs, snakes, crayfish, angleworms, caddis flies, and an occasional snail.

I have never seen where wild or tame otters have pursued and killed birds and animals in the wild streams and lakes. Sometimes a muskrat or beaver has shown up. The otters are interested but do not try to kill it. The same holds true for other animals and birds.

I have seen the otter catch thousands of crayfish (their favorite food) and hundreds of snakes, both poisonous and nonpoisonous.

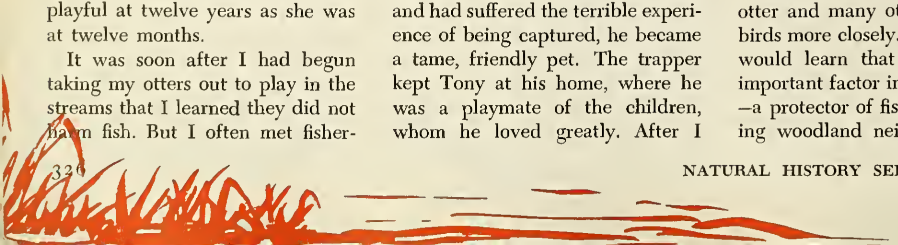
I obtained Tony from a trapper who had caught him in a steel trap when he was about three years old. His left foot was injured, and he had broken his teeth by fighting the trap, but in spite of the fact that he was an adult when caught and had suffered the terrible experience of being captured, he became a tame, friendly pet. The trapper kept Tony at his home, where he was a playmate of the children, whom he loved greatly. After I obtained Tony, I had him and some of the other otters with me at the Bronx Zoo in New York for two summers. Sometimes little children would run out on the lawn with the otters and roll and tumble with them. Tony would go to the toddler as he plumped on the grass and snuggle the child's face and caress his cheeks. He never forgot children.

Mrs. Rae Riggs, of Everglades, Florida, had pet otters that accompanied her to the post office for mail. When cars passed as they walked along the street, the otters would scurry under the shrubbery until the danger was passed. Like all otters, they loved to play in the house. Jocho would come in at bedtime, gather all her mistress's clothes, stack them in one corner of the room, and curl up and go to sleep on them. The night of the hurricane, Jocho and Jimbo became so frightened that they forced their way through the wire fabric of their pen. Jocho ran for the house, tore through the screen door, ran to Mrs. Riggs's bedroom, wet and chattering, climbed on her bed, and snuggled under the covers at her feet. Poor otters. Even after I brought them north they always got frightened in a thunderstorm.

Otters in zoos regularly beg for attention even though they have not been petted.

I have often been impressed by the memory of otters. On one occasion a young otter was brought to me, and after I had it three weeks the mother was captured in the wild and brought to me. She immediately recognized her baby, and there was a grand reunion.

Quite often we are startled as someone asks what we receive for our otter pelts. How can people think we could skin our babies, the sweetest most intelligent animals that ever lived? Of course we are not such idealists as to believe we can stop the harvesting of fur. But people would do well to observe the otter and many other animals and birds more closely. Doing this, they would learn that the otter is an important factor in nature's scheme —a protector of fish and a fascinating woodland neighbor.



enjoy them WHILE THEY LAST

Our slaughtered shorebirds sound a grim warning for the vanishing wildlife of Alaska. Today the same lies are being invented by men unwilling to admit their own guilt in the killing

By Ben East

UNLESS you are an old man, you were born too late to witness the great autumn flight of the shorebirds over the dun marshes of Cape Cod, the rush beds of Lake Erie, or the prairie sloughs of the Dakotas.

Fifty or one hundred years ago, massed legions of curlew and plover, yellowlegs and snipe, wheeled and dipped above the salt meadows and mud bars in the bright blue days of September, in numbers that challenge the imagination and defy

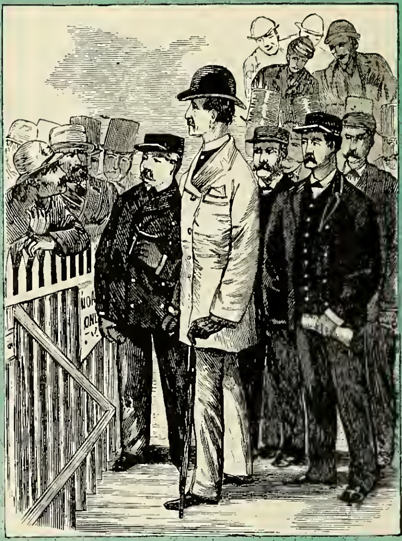
AMNH photo

▲ The Eskimo curlew *(Numenius borealis)* can now be seen only in a museum. Of the many shorebirds decimated by market gunners in the late nineteenth century, it suffered most severely. It is now probably extinct

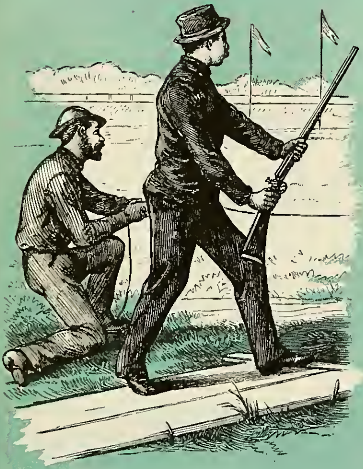
▼ Ruddy turnstones. In the days of abundance, the Boston market offered turnstones at 10 cents a dozen

Allan D. Cruickshank from National Audubon Society

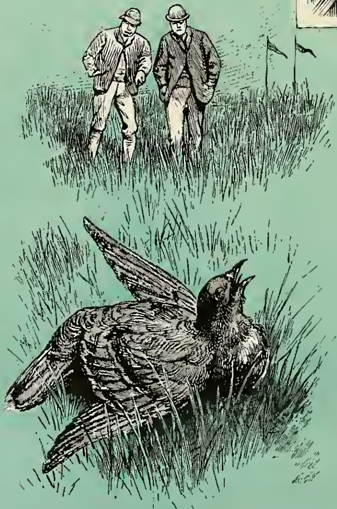
These drawings from 1881 show the conflict between a shooting organization that called itself the New York State Association for the Protection of Fish and Game and Mr. Henry Bergh, founder and president of the American Society for the Prevention of Cruelty to Animals. In this tournament at Coney Island, 201 contestants shot at 2000 live pigeons for prizes valued at $1490. During the shooting, men and boys cruised the field with sticks to kill wounded birds. A sensation was caused when small boys distributed a pamphlet by Mr. Bergh urging American citizens to "abolish this cruel and unsportsmanlike pastime."



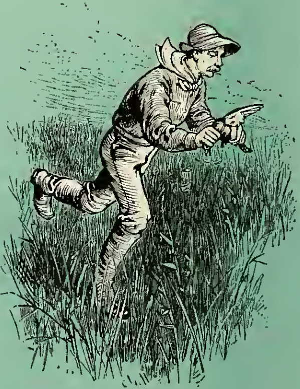
Mr. Bergh
was refused admission to the grounds



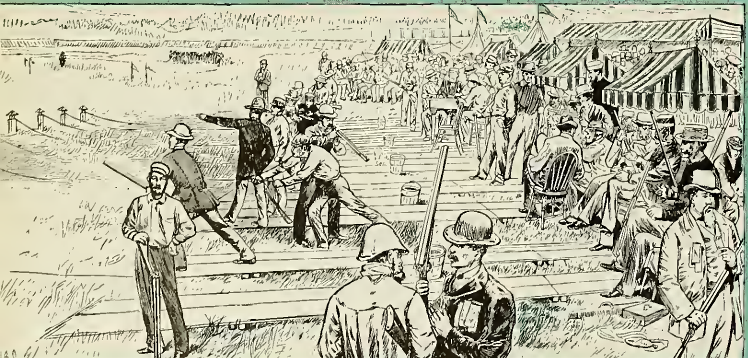
"Are you ready?"



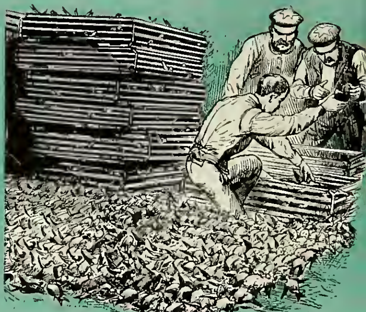
A disputed shot



Chasing
and killing wounded birds



General view of the tournament grounds



The victims of the day's sport

Allan D. Cruickshank from National Audubon Society

▲ **Birds** like the sanderling might have shamed the hunter by their size alone, but they stood high on the "game" list

description. The shorebird flight then deserved a place among the truly great wildlife spectacles that graced this continent. But it was gone before our time, sacrificed to the greed and short-sightedness of a generation that had neither understanding nor the will to practice restraint, dissipated by men to whom the sagging game bag was the only measure of a successful day afield.

Much the same thing is happening, many conservationists believe, in Alaska at the present time. And the same alibis are being given. We are told that bald eagles are destroying the white sheep, that caribou have taken new migration routes, and that the moose are simply falling victim to the wolves. So the tales run, echoing the selfsame theme as the stories men told 50 years ago to account for the tragic decline of the flights of plover, curlew, and yellowlegs in the United States.

Today the shorebird legions are a tattered remnant. Of all the clan only one, the woodcock, remains on the legal game list for hunters in the United States. And charming, wily gamester that he is, he is so unlike the others of the tribe, both in his way of life and in the kind of shooting he affords, that for practical purposes he should hardly be ranked as a shorebird.

Of the rest, the Eskimo curlew has probably gone beyond the help of protection. It is 20 years since the last specimen was taken; and though we have had reasonably reliable sight records within the past few years, practical conservationists fear that this bird may have joined the ghostly company that includes the great auk, the passenger pigeon, and the heath hen.

The others—the plovers and yellowlegs and Wilson's snipe—missed the same fate by a margin too narrow for comfort. Depleted by a slaughter that has hardly a counterpart for wantonness in the history of American field sport, they won respite from the guns only when their numbers had shrunk to the danger point and beyond, when they had dropped so far that it has taken years of protection to produce signs of a comeback.

Even if these birds returned to the full carrying capacity of the land, their marshes are now so limited in area that they could never regain their former abundance. The continual conversion of land to man's uses makes the birds increasingly dependent upon sanctuaries and refuges where the natural conditions are preserved.

I shall speak from now on in the past tense, even of those birds that remain, because it seems fitting to do so. They still perform their aerial drills above our autumn marshes, a fragment of a once great host, but the big flights are vanished to return no more. There are tens today where once there were tens of thousands. Vast reaches of marsh and prairie are empty and silent where once the sweet voices of these birds made an unending melody from dawn to dusk of each spring day. Skies across which their migrating flocks once drifted like swarms of overgrown bees know them no more. All things taken into account, the past tense seems to suit the shorebirds better than the present!

Natural-born wanderers, strong and swift in flight, they came close to claiming the championship of the feathered world for long-distance travel. Many of them nested on the sun-bright moorlands of the arctic and wintered below the equator.

▼ **Wilson's snipe**, long-billed recluse of the marshes. One gunner bragged of shooting 366 in a single day. In 20 years this one hunter killed over 69,000

Allan D. Cruickshank from National Audubon Society

Allan D. Cruickshank from National Audubon Society

▲ **The lesser yellowlegs** claimed an extensive winter range from the southern United States to the tip of the South American mainland. One hunter killed 106 at one time by firing into a flock on a beach

▼ **The golden plover.** Audubon estimated that 48,000 were shot in a single day in one Louisiana marsh

AMNH photo

Only the Arctic tern, capable of feeding from the sea itself, made a longer seasonal journey.

The Eskimo curlew, for example, was known in the United States only as a migrant. Its breeding ground was on the Barren Lands of Canada west of Hudson Bay, and its path of migration was a strange one. Quitting in July the remote and lonely land where they had bred and reared their young, the curlews headed eastward across the Canadian arctic, arriving on the coast of Labrador by early August. There they fed and loitered for a brief time, blanketing the hillsides and gorging on the purple-black fruit that came to be known as the curlew berry, until they were stained from bill to toe with its dark juice. By the time they left Labrador they had grown so fat that, tumbling from the sky at the hunter's shot, their breasts often burst open like overripe melons. In that fashion they acquired the name of doughbird.

From Labrador the migration moved across the Gulf of St. Lawrence to Nova Scotia, on the way to the far-off winter home of the clan. What happened next depended on wind and weather. If storm or fog hindered the birds, they followed the coast south, and at such times hunters on Cape Cod and other favored places in New England shot curlews by the wagonload.

If weather favored them, however, the doughbirds did not include the New England coast on their south-faring route. When they vanished from Nova Scotia they were not seen again until they made landfall on the coast of South America, 2000 miles away. Strong westerly gales, overtaking them on the flight, sometimes drove them as far off course as Iceland and the British Isles, but still they survived. Mid-September found them on the pampas of southern Argentina, 8000 miles from the tundra of Canada where they had pastured two months before.

The route of their spring flight was completely different. From the grassy plains of Patagonia, they came up across South America and reached this country in the region of the Texas coast. They then passed directly north to their nesting grounds through the prairie country west of the Mississippi. The Atlantic coast saw them in spring only as stragglers.

The golden plover followed an almost identical flight pattern and, in the old days, shared migration lanes and summer and winter home with the Eskimo curlew. Hunters looked confidently to find the two together.

The black-bellied plover, rated by many gunners as king of all the shorebirds, had a wider range and made a shorter flight. It laid its four spotted eggs in a moss-lined bowl on the tundra along the arctic coast of Alaska and Canada west of Hudson Bay. It migrated all across the continent and was seen everywhere from Cape Cod to Puget Sound, both spring and fall. Its winter home was in southern United States and northern South America.

The yellowlegs, both greater and lesser, known to hunters as the tattler because of its noisy ways, nested on the patches of muskeg that are scattered within the northern coniferous forest zone from Alaska to Newfoundland. On the salt meadows and over the countless small ponds of that lonely but beautiful land, its sweet clear call notes were a common sound through the long bright days of June and July. The greater tattler, lingering longer on its nesting grounds and reaching the United States later, earned the name of winter yellowlegs. The lesser was often called the summer yellowlegs. Both claimed an extensive winter range, from the southern United States all the way down to the very tip of the South American mainland. Many individuals made an annual round trip of 12,000 to 16,000 miles.

Magnificent travelers, the shorebirds, harboring no dread of distance and following migration lanes that led sometimes above marsh and prairie, sometimes over the empty leagues of the sea itself!

All the members of the great host had certain traits in common—qualities that endeared them to gunners and made them exceptionally vulnerable as targets. They traveled, migrated, and fed in flocks, many of them in close-packed bands from which it was no feat to drop a score with a single shot. They were swift of flight, wheeling, turning, dashing above the marsh, providing sporting targets. Yet they were easily whistled up, came readily to decoys. Often they were so unwary that when part of a flock dropped dead or wounded, the survivors came wheeling back time after time, calling plaintively to their fallen comrades, only to fall themselves in turn, until no more than a remnant remained to flee to the uncertain sanctuary of the outer mud flats.

They were conspicuous birds, most of them silvery-white below and dark above, flashing in the sun as they pivoted and drilled over the marsh meadows, sure to catch the gunner's eye and whet his shooting lust. And finally, they were fat and well-flavored, succulent table birds. Long years they hung in the market stalls of Boston and New York, Chicago, St. Louis, and other cities by the thousands and tens of thousands. Long years the guns of the market hunters raked them through spring and summer and fall, setting a record of slaughter not by the brace, not by the score, not even by the hundreds, but by the barrelful and the wagonload.

The story of the shorebird killing is an incredible tale. No chapter in the long chronicle of our sorry dealings with America's wildlife is more shameful or reveals more starkly the greed of the lusty days of our country's youth, the total lack of consideration for the generations that were to come after!

There were no limits save those imposed by skill and luck, weather and chance. The hunter shot while the opportunity lasted; and if he apologized, it was not that he had killed too many but because he had not killed more!

None of the clan was immune. Birds smaller than a bluebird and not much more wary than a caged canary were struck from the sky by the hundreds, gathered up, and toted home in brimming baskets. While the hunters waited for plover or yellowlegs or curlew—the "big birds" of the shore—to come to the decoys, they whiled away their time with the peeps, as they knew the members of the sandpiper tribe.

The least sandpiper, no bigger

▼ **Hunters** shot the willet throughout spring, summer, and fall. Nest robbers hounded it for the eggs wherever it bred

Allan D. Cruickshank from National Audubon Society

than a sparrow, was prized because it flew in dense flocks. The tiny spotted sandpiper was a legitimate target, too, but less popular because it was more solitary in habit.

Sanderlings, turnstones, and killdeers, robin-sized migrants whose smallness alone should have shamed the men who shot them, stood high on the "game" list of the shorebird hunters. Turnstones hung in the Boston markets at ten cents a dozen. The killdeer, best known of all shorebirds, was shot so heavily both for sport and market that it all but disappeared over large areas of the country.

And while the lesser shorebirds were dwindling, the campaign of destruction was being waged even more savagely against the bigger members of the tribe.

Of them all, Wilson's snipe, long-billed marsh recluse known to gunners as the jacksnipe, supplied the greatest kill. Authorities say more snipe fell before the guns of hunters than any other game bird in the history of North American field sport.

Just to cite one fragment of evidence in support of that claim, there was a hunter who shot in the marshes of Louisiana, for "sport" and not for market, in the 20 years from 1867 to 1887, and published a complacent record of his kill. In one day, in December of 1877, he shot 366 snipe in 6 hours! He could have done much better, he explained, had he shot with two guns and used a loader. In 7 days of shooting that winter he accounted for 1943 jacksnipe. The winter's kill was 6615; and in 20 years, more than 69,000 snipe died to satisfy the egotism and blood-lust of this self-styled "sportsman."

Commenting on his kill, he unwittingly set down in clear and simple words the creed of his time toward all wildlife, the creed that sealed the death warrant of the great shorebird flights and shorebird shooting. "The snipe being such great migrants, and only in the country for a short time," he wrote, "I had no mercy on them and killed all I could, for a bird once missed might never be seen again."

All across the country, from Canada to the Gulf and from Cape Cod west to the prairies, there were thousands like that, some shooting for sport, some for a livelihood. It is little wonder the jacksnipe is no longer on the open list, little wonder the fall flight of yellowlegs has dwindled to a thin wisp that passes like ghostly smoke over the sea marshes of Monomoy. Little wonder if the Eskimo curlew is gone forever from the curlew-berry patches of Labrador and the mud flats of Nantucket!

Hugh M. Halliday from National Audubon Society

▲ BEST KNOWN of our shorebirds, the killdeer was all but exterminated from large areas of the country

Allan D. Cruickshank from National Audubon Society

▲ BEING SOLITARY in habit, the tiny spotted sandpiper was hard to get, but it too was sought by the gunners

Allan D. Cruickshank from National Audubon Society

➤ MARBLED GODWIT, pausing to feed on a beach

It was the misfortune of the sweet-voiced willet to nest within the borders of the United States, along the Atlantic seaboard. Not satisfied with hunting him throughout spring and summer and fall, including the full period of his breeding season, men set a price on his eggs as well, and nest-robbers hounded him wherever he bred.

The dowitcher, the brown-back of the hunters, was among the least wary of all shorebirds, returning to the guns time after time in response to a whistle that mimicked the cry of a wounded bird. Flying and alighting in compact formations, it was not unusual for 20 to 30 of these big snipe to fall at a single shot. Audubon saw 127 killed at once by the discharge of three barrels. The dowitcher went swiftly from abundance to rarity and missed by a hair's breadth joining the passenger pigeon in the Legion of the Vanished.

The story of the godwit was much the same. It was still sufficiently numerous in the '80's on the prairies of Minnesota that if its nesting grounds were invaded, it hung in bands of half a hundred above the traveler's wagon, where its loud notes of protest made a deafening din. Forty years later a man could have crossed all that prairie country and counted himself fortunate if he heard the alarm cries of a single godwit!

What a striking and sorry parallel exists between the story of the luckless godwit and Alaska's caribou, numbering tens today where there were thousands no more than three decades ago!

Next to the jacksnipe, the heaviest toll to the guns was paid by the yellowlegs, plovers, and curlews. A few scattered episodes serve to document the staggering record.

A shipment of nearly 500 yellowlegs went in one day from the marshes at the mouth of the Merrimac to a single game stall in Boston in 1904. A Rhode Island hunter accounted for 1362 yellowlegs in 8 seasons, and another killed 106 at one time by firing into a close-packed flock on the beach.

The big black-bellied plover, the beetlehead of the gunners, was more wise and wary than most of his kinsmen, but that was not enough to save him. He died by the scores before the beach pits and seaweed blinds, and the markets that retailed turnstones and yellowlegs and curlews rated him one of their best birds.

The golden plover kill is hard to believe. In 1821, Audubon spent a day at Lake St. John, near New Orleans, shooting with a party of French gunners. There were 200 hunters in the marsh, strung out in lines of 20 to 50 at promising places. The shooting was continuous from sunrise until after sunset. One hunter killed 750 plover, and Audubon estimated the average take of the 200 guns at 240 birds apiece, a total of 48,000 that fell in one marsh in a single day. And that was an ordinary day, and in March, too, when the spring flight was moving north to the nesting grounds!

So plentiful was the Eskimo curlew that the hunters were not satisfied with a brimming wagonbox, even when sideboards had been added to double the capacity. It was no rare practice, on days when the shooting was good, to dump an entire load of dead birds and leave them to rot in the spring sun, refilling the wagon with a fresh kill.

And when the great flocks were seen no more, the old tales were told as to why the birds had disappeared, the old alibis offered by the men who had wiped them out. Storms had blown the curlews out to sea, they said. Epidemics had overtaken them in the far north. Their summer food supply had failed, and they had perished of hunger. They had changed migration routes and were going north and south by new and undiscovered paths.

The same stories were told of the pigeon. They have been told of every bird that has grown alarmingly scarce or disappeared from the earth. The answer to all of them is the same. They are plain and simple lies, invented by men unwilling to admit their own guilt in the sorry business of wildlife genicide.

No evidence of disease was ever found in the Eskimo curlews, and their arctic pasturelands fruited each summer with lavish profusion. They were strong flyers, and their migration was prolonged from July to September, so that no one gale could have overtaken more than a small fraction of the flight. As for new migration routes, that was the thinnest alibi of all. By the time that tale was spun, the gunners were covering, spring and autumn, every mile of salt marsh and beach and prairie across the continent by which a curlew or any other shorebird could pass between its summer and winter home!

The facts were simple, the story clear. The doughbird had vanished for one reason and one alone. It could no longer run the long gauntlet of the guns across two continents, from the pampas of Argentina to its arctic nesting grounds and back. The smoking guns, both of market hunters and "sportsmen" who had no understanding of the meaning of the word, took a greater toll than the gentle bird could endure!

For that same reason the other shorebirds dwindled from a mighty host to a sorry, ragged company!

Their death was needless and without excuse. They were friends, not foes, of agriculture. For the most part they bred in the far north where vast nesting grounds still await their return. They wintered chiefly south of our limits, in countries where the lack of sporting guns would prevent excessive shooting even today.

They would still be here, the beetleheads and tattlers, the golden plovers and doughbirds, were it not for the spendthrift attitude of an earlier generation. We would still be knowing the pleasure of their presence, in that season when the marshes put on their bronze livery and the morning wind smells of fall, had the need for wildlife protection been understood and respected a few decades sooner.

Will the same thing happen in Alaska? Is the last primitive storehouse of wildlife remaining under the American flag being drained in the same headlong fashion that marked the reckless depletion of the shorebird host? All available evidence indicates an affirmative answer. The alarming decline of many of Alaska's game animals is past denial.

The caribou herds of the interior have all but vanished. Competent wildlife authorities say there are not 500 caribou now in areas that formerly harbored half a million or more. The Dall sheep has dwindled so alarmingly that the Alaska Game Commission gave the species the full protection of a closed season in 1949. The Sitkan blacktail deer have been seriously reduced in numbers. The moose population of the Kenai Peninsula is little more than half what it was fifteen years ago. Even the bald eagle, the bird that holds a proud place as the national emblem of America and enjoys complete protection in the continental United States, is being hunted down in Alaska now under a vicious and indefensible bounty law!

Without exception, Alaskan wildlife authorities agree that excessive shooting, both legal and illegal, is the foremost factor behind the rapid shrinking of the Territory's game supply. Other factors, such as increased wolf predation, admittedly enter in, but they are not the key to the situation. The wildlife treasure house is being emptied largely for lack of adequate funds to enforce the game code and keep harvest in balance with supply. Result: the same type of ruthless and unregulated killing that doomed the shorebirds in an earlier day.

Shall we correct this mistaken policy in time? Shall we reverse the trend of reckless slaughter and inadequate protection before it is too late? Before the roof-of-the-world white sheep has joined the doughbird in extinction? Before the giant moose of the Kenai have shrunk down to a remnant comparable with the tattlers? Before the caribou has gone the way of the golden plover?

The answer rests largely with unselfish conservationists outside Alaska. There are competent game officials in Alaska eager to do the job if they are given the money with which to do it, pleading for a chance, begging Congress for the needed funds. And there are enough Americans who love wildlife, if they will lift their voices in effective unison, to secure for the remaining Alaskan game herds the protection they must have to survive and regain their former plentitude.

The shorebirds stand as a sorry but classic example. The result of unregulated killing and inadequate protection was never proved more clearly and forcibly than in their case. It is not yet too late, in Alaska. But it is later than many realize!

BOOKS

Continued from page 295

about human biology. Some of it is undoubtedly oversimplified, but the general impression this book makes is a good one.

Harry L. Shapiro

NATIVE ORCHIDS OF NORTH AMERICA

- - - by Donovan Stewart Correll

Chronica Botanica Co.,
Waltham, Mass., $7.50
400 pp., 148 illusts.

THE popularity of the orchid family of plants among amateur botanists and gardeners makes this specialized work of more general interest to the nature lover than an equally technical book on any other plant family. This popularity is shown by the publication through the years by nontechnical houses of several books describing the orchids of the United States, mainly those of the Northeast. Since the latest, *Our Wild Orchids* by Morris and Eames, was sold off as a remainder some ten years ago, the orchid lover has only been able to obtain information about the native orchids in the pages of a general botany. The appearance of a new work is doubly welcome, not only because it fills a gap in botanical literature, but because it is the first really comprehensive work on North American orchids. The range covered by this work includes Mexican and West Indian species, many of them epiphytic, which did not come within the scope of the earlier works.

The technical appearance of the book is ameliorated by the readable popular discussion of the habitats and growth habits of each variety, which follows the fine-print botanical description. At the end of each of Correll's descriptions he has included, whenever possible, a paragraph of cultural notes by either Dr. E. T. Wherry or J. V. Watkins Transplanting and culturing hardy orchids in the garden is difficult at best; Dr. Wherry's notes should be taken seriously, and the gardener who is unable to supply the requirements as outlined should not undertake it.

The book is well illustrated with sketches of the full plant, the flower, and dissected parts by Gordon Winston Dillon and by Blanche Ames (Mrs. Oakes Ames). It would be difficult to criticize anything specific about the work. Dr. Correll has done an excellent job with the text, and his competent collaborators have each made valuable contributions. While it is in appearance and in fact a technical and specialized botanical work, it is also a book that any plant lover will enjoy, and the wild gardener will find it essential. He may not succeed in his attempts at orchid cultivation, but he owes it to the plants he introduces to learn as much as he can about their requirements before making the attempt.

F. H. Pough

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Three Lakes, Wisconsin

LETTERS

Continued from page 290

Java, since N. Wing Easton remarked that warning signs had been posted at various places in the country where they might be needed to call attention to the danger.

I have seen no recent account of the crater in question, which is on the Dieng Plateau, but presumably it is still in existence. The Dieng volcano is said to have been without an active eruption since 1600 or before, but this does not preclude gaseous emanations. The original account by Loudon mentions an earlier note by a Dr. Horsefield, who said he had heard of the Dieng crater but was unable to persuade the natives to show him where it was. It is easy to imagine their unwillingness to have anything to do with such a place.

Hades in Dominica

A dramatic account of a volcanic valley somewhat similar to the one described above but in the island of Dominica in the West Indies will appear in NATURAL HISTORY in the near future. Do not miss Stuart E. Elliott's "The Mouth of Hell."

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CONSERVATION NEWS

Help for the Vanishing Key Deer

With no more than 32 of the diminutive animals left, word comes none too soon that a meeting was recently held in Key West to explore further the possibilities of a refuge for the animals whose precarious condition was emphasized in an article in the June issue of NATURAL HISTORY Magazine. The survival of this unique little creature is considered doubtful unless at least 200 of the animals can be maintained under natural conditions.

The recent meeting, presided over by Congressman Lantaff of Florida, is reported to have resulted in the settlement of many problems between local people and the U. S. Fish and Wildlife Service.

A bill has been introduced in Congress to provide for the establishment of a refuge for the Key Deer. The bill has been undergoing revision, and readers should urge passage of the amended bill by writing to the House Committee on Merchant Marine and Fisheries, under the Chairmanship of Edward J. Hart of New Jersey. Urge adoption of the bill to protect the Key Deer, HR 2897, and if possible send a copy of your letter to your own Congressman.

Hope for the Sugar Pines

Readers who recall the urgent plea to save the Sugar Pines of Beaver Creek Valley, published in NATURAL HISTORY for February, 1948, may be heartened to know that all is not yet lost. The U. S. Forest Service has indicated that it will take steps to acquire from the Pickering Lumber Company the tract known as Unit 3, which corresponds very closely to the area designated as most urgent in the NATURAL HISTORY article referred to above.

The area that should be preserved extends for about two miles along the southeastern slopes of Beaver Creek Valley and is flanked on the southeast by the South Sequoia Grove. The U. S. Forest Service is offering the Pickering Lumber Company certain other timber in exchange for Unit No. 3 and has pledged to keep this tract inviolate. It promises to allow no trees to be cut on it, so that as funds are contributed for the purpose, this unit can be added to the proposed State Park, which is to embrace the South Calaveras Grove. The California State Park Commission heartily endorses this exchange.

Citizens aware of the need of preserving the finest Sugar Pines remaining in the world—trees that reach eight feet or more in diameter—are urged to remain vigilant and to lend their support in the formation of a strong public sentiment, which alone can bring these pledges and plans to permanent realization.

Gratification is felt in the realization that it is quite unlikely that as much progress as this could have been made but for Dr. Willard G. Van Name's eloquent plea for the Sugar Pines in the February 1948 issue of NATURAL HISTORY.

THE IDOL OF THE CAVE

Continued from page 318

sharp points, we had the unexpected job of filling in these *dientes de perro* ("teeth of dog"), as they were called by the local Cubanos. When this job was completed, what a thrill it was to ride our horses over the new trail right up to the mouth of the Cueva del Agua!

But now came the real problem —removing the idol—and the more we studied the situation, the worse it looked. Even if we could get the idol loose in one piece, we certainly could not carry it. Yet we did not dare break it up by force for fear of shattering it.

I do not remember who suggested a cross-cut, two-man wood saw. I was doubtful, but we bought an old one from the Mosqueras and tried it on another stalagmite. It worked—slowly, to be sure, but efficiently; and I learned for the first time that a wood saw will cut limestone. It took Gaspar and Cecilio a little over a week to saw the idol off its base and into pieces small enough to carry out of the cave, out of the hole, and up the cliff to La Patana, where they were loaded on our own pack mules. Within a few hours they were at the lighthouse at Cape Maisí.

With no boards available, there was only one answer to the problem of boxes. We sawed boards out from a "cedar" log with an old-fashioned pit saw; and we had the nails. For packing, we used Spanish moss from trees in another locality.

In due time, the schooner that brought supplies for the lighthouse arrived and anchored offshore. Don Ramón, lighthousekeeper, sent a messenger, and I rode down posthaste to make the arrangements. The boxes were carried out in a rowboat to the schooner, which delivered them to the wharf at Baracoa, to await the Norwegian banana ship that would transport them to New York.

Once safely received, the pieces were reassembled; and the idol of Cape Maisí, at long last, was put on exhibition at the Museum of the American Indian, Heye Foundation, where it may still be seen.

daydream of burning a man's hayrick by a daydream of saving that man's cow until the whole took on the structure of reality for which he must later become answerable to God, the Bolshevik insists that the outer reality fit his diagnosis of the historical process. Thus he insists that there must be hunger and poverty in capitalist countries and relatively great wealth and prosperity in the Soviet Union. Later the regime maintained this reality by "re-educating" those unfortunate occupation troops who had witnessed the higher standard of living in the "capitalist countries" of Central Europe. The stronger the demand for control grew, the more it generated a fear of the least freedom in themselves or in anyone else, and the stronger the correctives had to become, the more searching the police vigilance.

Now what of the new young Soviet citizens, either those trained for leadership in the Party or the "non-Party" people—schoolboys, soldiers, technicians, writers—who have been reared in an atmosphere where Bolshevik leadership, endlessly suspicious and fearful, was attempting to force on the children of the Soviet Union a new character structure appropriate for a new kind of world. This is what we need to know most, and about it we have only the very scrappiest evidence—from films, from literature, from the defectors among the Soviet occupation troops who fall in love with a German girl and make a break for the American zone.

We know something of how they are reared and how the battle of the regime against swaddling failed, so that the bulk of Soviet children are still swaddled, though probably not as tightly or for as long a period. We know that, although the official literature disapproves of grandparents and extols as ideal a family containing only parents and children, the old country-bred grandparents are still a factor. Under the crowded housing conditions, the large group still exists to accustom a child to the presence and the voices of many persons, as did the communal life of the village. We know that there is official pressure to train children early, to teach them to use their hands, to insist upon punctuality, neatness, order. On the basis of our knowledge of the way human children develop and of the way the old culture fitted together, we may expect that the young Soviet citizen will have some of the traditional fear of his own ungoverned impulses and the corresponding belief in the importance of a strong state authority, reinforced by modern Bolshevik training in the value and importance of control. ("In the Soviet Union," said a recent anti-Soviet DP, "it is impermissible to *think* 'shut-up,' " and this was said in disapproval of the freer ways of modern American children.) We may expect that there will be a strong potential revolt against authority and a corresponding demand for authority, so that young Soviet citizens will dream of throwing off the Soviet yoke, but only in order to establish some other absolute form. We may expect that the training they have been given in accepting a reality that includes not only tractors and machine combines but also a variety of "well-known" dogmas about capitalism and communism, will make it very difficult for them to accept evidence that conflicts with their rigid beliefs. Nor may we expect them to adapt flexibly to the demands of mass production, but they will have an enormous capacity to bring all their energies to bear on any given activity. We may expect this capacity to be dependent upon their belief in the strength and omniscence of the system, a belief that, in turn, will act as a stimulus to the continuance of the control by a secret police system. We may expect everything we do to look different to them from the way it looks to us. For example, in the picketing incident outside the Russian delegation's UN headquarters, last July, the leader of the anti-Soviet pickets "declared the police had been notified in advance . . . and permission to picket had been granted. After the demonstration, he said, police officials had complimented the group on its orderliness." This compliance with American requirements of law and order showed the Soviet Government, however, "that the assemblage of hooligan mobs before the building of the Soviet delegation to the United Nations was known [and therefore, of course, approved!] earlier to the American authorities, because a squad of police arrived at the building of the representatives from fifteen to twenty minutes before the appearance of the above-mentioned group."

In communicating with people who think as differently as this, successful plans either for limited co-operation in the attainment of partial world goals or for active opposition depend upon our getting an accurate estimate of what the Soviet people of today are like. We must know just what the differences in their thinking and feeling are—not because they are basically different from Americans, not because they have one jot less of native intelligence, sensitivity, and potential desire for freedom—, but because they have been reared within a system whose leaders, themselves rebelling against a centuries-old tyranny, incorporated in their new political system a tyranny more effective, more ruthless than the one against which they fought.

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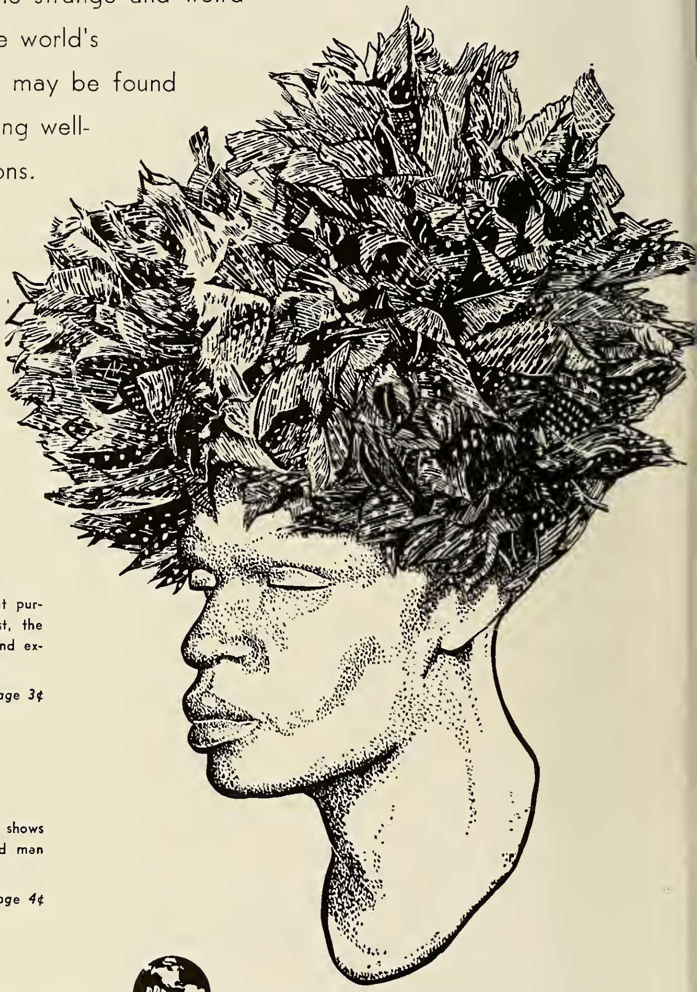

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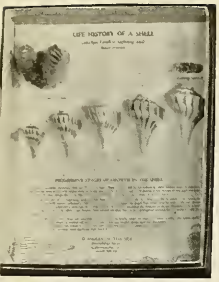
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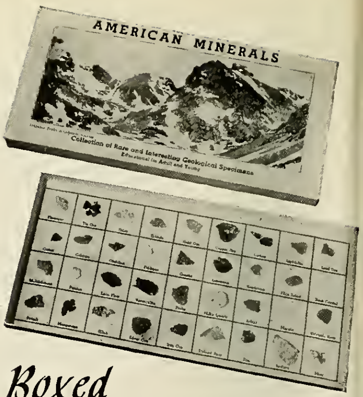
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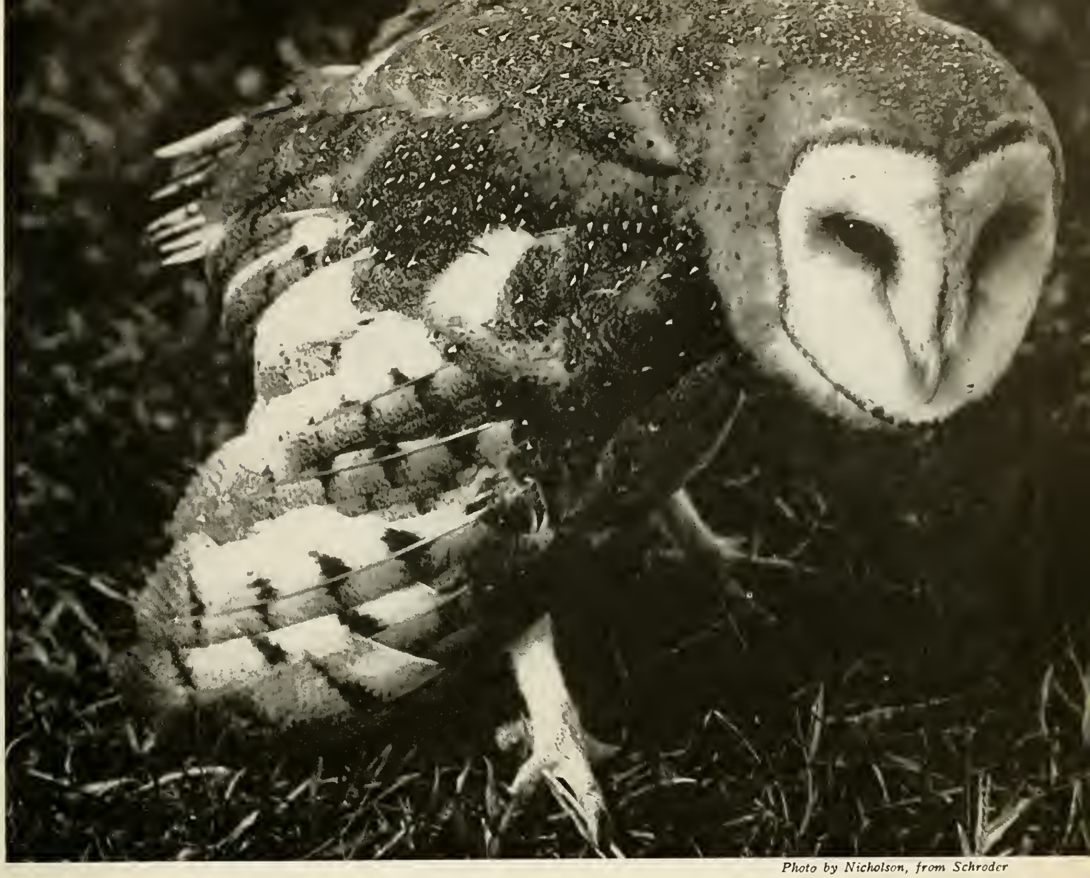

Photo by Nicholson, from Schroder

▲ A WELL-GROWN young Barn Owl in a defensive posture

LETTERS

Bats in the Wall

SIRS:

It occurred to me that you might help us with a problem connected with our Maine cottage in the woods. For the last several summers some bats have located themselves in the space between the shingles and the inside boards on the side of the wall next to the chimney. We cannot remove the shingles without tearing down the chimney. Is there any spray we could use to dislodge these bats?

MRS. MALCOLM MCFAULL
Jackson Heights, N. Y.

The following answer is given by Mr. T. Donald Carter of the American Museum's Department of Mammals:

Bats generally enter the walls of houses from the outside, and they secrete themselves under clapboards, shingles, or inside the walls. You should try to find the hole by which they have entered, and it will probably be easy to recognize, because it will be rimmed with brown. Bats generally conceal themselves during the day and go out at dusk to feed. Mothballs, which bats dislike, can be placed around any likely spots. But the holes should, of course, be stopped up. Until you have gotten rid of the bats and solved the problem so that others cannot enter the wall, you can comfort yourself with the thought that bats are entirely harmless and that they serve man in the most beneficial ways.

How Maternal the Python?

SIRS:

In his book, *Africa, I Presume*, Alan Reeve describes an experience he had in Nairobi. He says: "After dinner with Miller, he led me across the lawn to my bed room, a circular thatched guest hut. As he set a lamp on the table, I pointed to a live python at the head of my bed." The snake was then killed with a stick, and Reeve says, "The python was only a youngster, no longer than three feet. But I slept uneasily that night, expecting a long thick avenging monster of a mother to drop from an overhanging branch and slide through the thatch."

I had supposed that no snake took an interest in or even recognized her young once they were born. Were Mr. Reeve's fears justified?

MRS. GERARD P. HERRICK
New York, N. Y.

The following remarks are offered by Charles M. Bogert, Curator of the American Museum's Department of Amphibians and Reptiles:

Mrs. Herrick is right. The female python evinces no interest in her offspring once they have emerged from the egg. On the other hand, pythons provide some

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

▲ BAZOOKA: a most remarkable raccoon belonging to Mr. Emil Liers, the celebrated friend of the otter. Bazooka loves to travel with the otters in the station wagon. During stops to exercise the otters, Bazooka does not climb a tree and make his master waste time coaxing him down. He watches to see when the caravan is ready to drive on and is the first person to get aboard

protection for their eggs, coiling about them for the duration of the period of incubation. The eggs are heaped into a conical mass, around which the female coils, with her head resting on the center. Usually the eggs are completely hidden.

It may be assumed that such behavior serves to protect the eggs from predators. It also serves to prevent the eggs from drying out. And what is of even greater interest, the body temperature of the brooding female is slightly raised while the eggs are being incubated. This heat production in the python is an extraordinary attribute, considering that reptiles ordinarily derive virtually all of their heat from external sources, by basking or by resting on the warm ground surface.

Other reptiles, including such lizards as skinks and the limbless "glass snake," coil about their eggs and remain with them until they hatch. So do some Asiatic pit vipers, which, unlike their American relatives, the copperheads and moccasins, lay eggs instead of giving birth to living young. It is possible that the bushmaster—apparently the only American pit viper that lays eggs—remains on hand to protect the clutch. On rare occasions, men have been attacked by bushmasters without provocation, possibly because the victim happened to wander close to a clutch of incubating eggs.

There is good evidence that the king cobra of southeastern Asia guards its eggs. The late Colonel Frank Wall, an extraordinarily competent student of snakes, states that the brooding female is especially sensitive and usually attacks an intruder on sight. It is uncertain whether she remains in attendance throughout the entire incubation period, but she is undoubtedly present for some time. In some instances, both parents seemingly guard the nest. Few other snakes are quite so aggressive when enraged as the king cobra, which attains the greatest length of any venomous snake, specimens over 18 feet long having been measured.

In Africa, the black mamba has acquired an equally sinister reputation for attacking without provocation, and here again there is some intimation that the female may be protecting her eggs. Natives, not without reason, shun the places believed to be the mamba's "breeding grounds," although it has not been conclusively demonstrated that aggressive mambas are confined to the vicinity of their egg clutches. One mamba is said to have created a reign of terror that lasted for three years in Rhodesia and accounted for eleven human victims. However, such stories are open to considerable doubt. The black mamba may well be the most dangerous snake in Africa, but it can scarcely be so diabolical as depicted.

It is possibly of some significance, nevertheless, that many of the more aggressive snakes, especially the larger species, appear to be protecting their eggs. However, parental care is limited to the eggs. The young evidently scatter to shift for themselves soon after they slit the leathery shell that has encased each of them during their embryonic life. Presumably the female then resumes her routine existence, searching for her own prey and leaving her offspring to do likewise.

And a python would have to be an extraordinarily busy creature to attempt to follow the movements of each member of the brood. The African python in the London Zoo deposited about 100 eggs. Under natural conditions, most of these would have been fertile; and the old woman who lived in a shoe would have had a picnic by comparison!

Man "Bites" Snake

SIRS:

The New York *Herald Tribune* not long ago carried a United Press story about a rattlesnake that bit a man and died. Demetrio Gomez, a civilian employee at Kelly Air Force Base is quoted as having said that the rattler bit him on the leg, had convulsions, and then crawled 15 feet and died. Mr. Gomez himself suffered no ill effects. He explained the snake's death by the fact that, as head of the plating unit at Kelly Base, he handles a great deal of sodium cyanide, which is a deadly poison. "My body is so full of this poison," Mr. Gomez said, "that it has gradually built up a resistance to it, but I guess the snake had not."

Do you think it possible for the rattler to have taken sufficient blood to produce death? If so, how would he get it?

J. M. HOLLISTER

Stowe, Vt.

The following information is offered by Bessie M. Hecht of the American Museum's Department of Amphibians and Reptiles:

Medical men are agreed that no resistance can be built up to sodium cyanide. And when a rattler strikes, the action is a very fast one, no blood being taken up by the fangs. The only blood that could possibly be transferred to the snake would be a small amount that might be left on the fangs if they pierced blood vessels at the instant of the biting. Certainly this amount would not contain enough sodium cyanide to kill the snake. Only if the man had had a tremendous quantity of cyanide in him could this occur, and in that case he would not be alive to tell the tale.

Perhaps if the man's trousers had been completely saturated with the poison, the snake might have gotten enough cyanide in its mouth to cause its quick death. But the fact that the man suffered no ill effects makes it exceedingly doubtful that his flesh was punctured at all. We know of

Continued on page 382

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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Wayne M. Faunce, Vice-Director
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VOLUME LX—No. 8 **OCTOBER, 1951**

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You will find Natural History Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

This imposing slab of rock, towering thin as a chisel into the desert blue, is located in Arches National Monument in eastern Utah. Its name is the Great Organ, and it is typical of the gigantic fins, steeples, towers, and spires that make this rocky region famous.

Some day, the forces of erosion may perforate this slab and make of it a natural arch. Most of the 81 arches in the area, however, are in the Windows Section, whereas this rock is in the Courthouse Towers Section. It can be reached by a two-mile walk from monument headquarters, which is five miles by automobile from Moab. The color photograph was taken by Jack Breed.

This fascinating region can be visited conveniently on the way from Monument Valley to Salt Lake City or points east in Colorado. The Monument is open all year.

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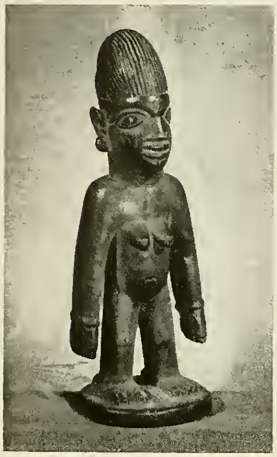
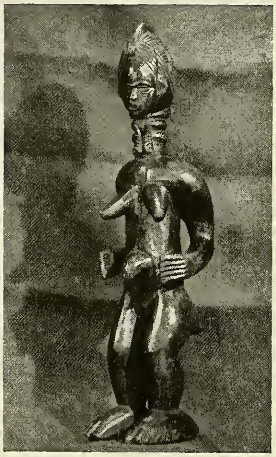


WEST AFRICAN FETISH FIGURE NO. 3

Yoruba, Southern Nigeria. 11 inches high, brown wood. This is an Ibegi figure, kept by a surviving twin to appease the spirit of his dead twin.

$12.50, packing charge 65¢



MENDI STYLE FIGURE NO. 9

Gabun Territory, West Africa. 20 inches high, brown wood. These fetish figures are used by the priestesses of the Tassi Society to receive decisions from the spirits.

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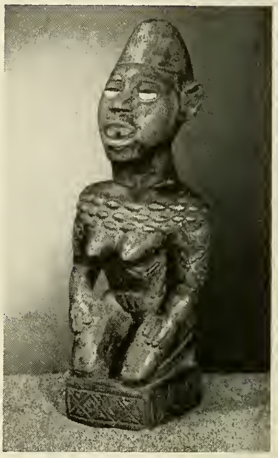

WEST AFRICAN ANCESTRAL FIGURE NO. 4

Bakongo, Western Belgian Congo. 11½ inches high, brown. The Bakongo are noted for their realistic sculptures.

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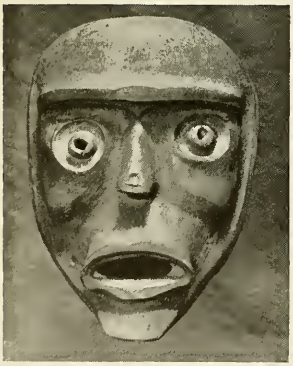

NORTHWEST COAST INDIAN NO. 6

Kwakiutl, Vancouver Island. 12 inches high; gray wood. This mask represents a mythical creature called the Paddler in Kwakiutl legends.

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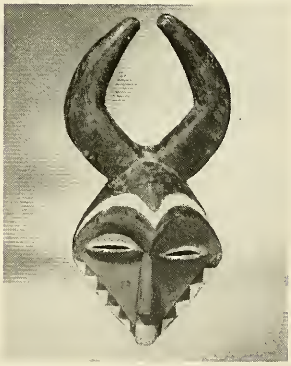
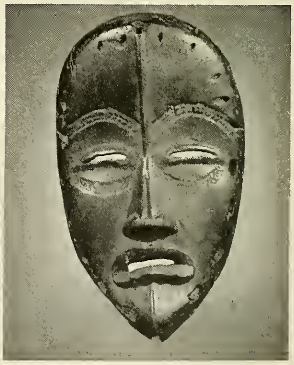


WEST AFRICAN DEITY NO. 1

Bapende, Belgian Congo. 14 inches high; black, white & red. This piece represents a sylvan deity.

$18.00, packing charge 90¢



WEST AFRICAN CEREMONIAL MASK NO. 2

Dan, Ivory Coast. 9 inches high, black wood. This mask is used in ceremonies of the secret Poro Society. It is rich in scarification markings.

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FORESTS AND MEN

-------by William B. Greeley

Doubleday and Co.,
$3.00, 255 pp.

THIS book is written by one with an almost lifelong connection with the lumber industry. All through its pages one glimpses the view that forests have no other excuse for existence than to be logged off and converted into manufactured products. Yet even to a conservationist, it must be admitted that this is an entertaining and interesting book. It contains a wealth of information, not so much about the forests themselves as about the ways they were used, or more correctly, misused, plundered, and wasted. It tells about the terrible destruction by fire that they have suffered and also about a few of the ways, often entirely illegal, by which private ownership of most of the good timber on the government lands was established.

It tells of the sincere efforts of some of our former presidents (especially those of Theodore Roosevelt) to establish a system of government forest reserves that would bring profit to the nation and avert a future timber famine. But political and commercial domination of the Forest Service, the bureau established to manage these forests, soon put an end to any such hopes. That bureau has not only never shown a profit; it has been a heavy expense to the nation every year. And the magnificent stands of timber that many of the national forests used to contain have been entirely made away with. It is only in a few of the National Parks that a few samples of our splendid primeval forests of immense trees, one of nature's most beautiful and inspiring manifestations, may still be seen. Few people realize how very few and how very small the still existing tracts are.

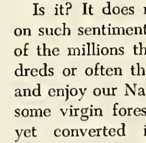
The serious defect in the book is that it shows only the sunniest side of our forest problem. It does not soft-pedal the dark sides; it just ignores them completely. Its author is overflowing with joy at the infinitely numerous uses for wood that are constantly being discovered. He is not talking about lumber in the form of boards, for the days of boards and of real forestry to produce them are approaching their end, but as wood pulp for paper, cartons, and containers for everything and anything, veneers and plywood, wood fiber and ground-up wood as a constituent of plastics and a thousand other products. We admit that the immediate future looks bright for timber owners just now, but how long can the forests stand the increasing strain?

Few people will agree to the claim of this book that regrowth of our forests is now nearly equaling their destruction. Their area is diminishing in almost every part of the country, and what is more serious, the average size of the trees is smaller. Everywhere all the good land has been or is being taken up for other purposes. It is true that in course of time trees will grow on nearly worthless land, but they are nearly worthless trees and take almost forever to grow.

A short quotation from the book will show the commercial point of view of its author most clearly. "It is only human to deplore the passing of the 'tall whispering pines' . . . But let us not be too hasty in writing off the virgin forest. Every flight across the midwestern states by airplane leaves me with a feeling that the pine forests of the Great Lakes are with us still. The virgin trees have been transmuted into homes, churches, and factories, into solidly built farm houses and barns. The forest has kept right on living with the people . . . The first old trees are gone but the forest is here to stay."

Is it? It does not seem that comment on such sentiments is needed. How many of the millions that annually travel hundreds or often thousands of miles to see and enjoy our National Parks and look at some virgin forest still growing and not yet converted into plywood housing developments will agree with these views? Incidentally, it may be mentioned that, although the book is entitled *Forests and Men*, National Parks, or for that matter parks of any kind, are not alluded to in it.

WILLARD G. VAN NAME



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THE ELK OF NORTH AMERICA

-----------by Olaus J. Murie

The Stackpole Co. and Wildlife Management Institute. $6.50, 376 pp., 62 illusts.

THE elk is one of the finest species of North American mammals and deserving of an impressive book. No one could be better qualified to write such a book than Olaus Murie, for he has the long years of field observation to give him the facts and the broad, tolerant understanding of wildlife relationships to make the best use of these facts.

This big deer has become too well known as elk, an Old World name for the European moose, to justify any attempt to drop the misnomer from current American usage. Hence the author uses this name freely in the book as well as the other name frequently heard, wapiti.

Murie develops his subject in a simple and logical fashion. He touches upon the matter of names, he describes briefly the six distinct forms living today, and then proceeds to develop the life history of the animal. The bulk of the book is devoted to an accurate account of the characteristics of the elk, its habits, its enemies, its diseases, and the pertinent factors that dictate wise elk management. The day is past when this animal could be left as an undisturbed element in a natural environment.

The elk is migratory and requires more territory to live undisturbed than is now available to it. An overabundance of elk plays havoc with the summer range. In some regions the sportsmen do not kill enough animals under normal hunting conditions to keep the elk in balance with their food supply, and there is a very active public sentiment for keeping the numbers as great as possible. The problem has enough irreconcilables to call for the judgment of a Solomon.

Anyone reading this excellent book will appreciate the difficulties involved in satisfying everyone who manifests an interest in the welfare of the elk.

The book is well illustrated. The frontispiece, in color, from a fine painting by Walter A. Weber, is by courtesy of the Frederick C. Walcott Memorial Fund.

HAROLD E. ANTHONY

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Edwin H. Colbert

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This first McGraw-Hill book in a new series published jointly with the American Museum of Natural History describes in fascinating detail how beasts as big as boxcars lived and fought and died with earth-shaking violence. Dr. Colbert traces the evolution of grass eaters, carnivores, sea serpents and birds, from the earliest geologic ages down to the present. With hundreds of photographs, line drawings and charts; index and glossary. $4.00

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STEVE MATHER OF THE NATIONAL PARKS

---------by Robert Shankland

Alfred A. Knopf, $4.00, 326 pp.,
25 illusts.

THIS book has a dual interest. Mather, the man, could be worth a book regardless of the field in which he chose to work, and the topic of the National Parks is of perennial interest to every nature lover.

The account of Mather's activity in National Park matters begins several years prior to the establishment of the National Park Service. The reader is prepared for the story of this activity by several chapters of biographical data which bring out the qualifications of the man. He demonstrated in civil life a capacity for accomplishment which later found expression in Federal employment.

During Mather's tenure in the Department of the Interior, nearly fourteen years, the holdings of what is now the National Park Service grew from thirteen parks and eighteen monuments to twenty parks and thirty-two monuments. Beyond this, there was an expansion of the Service's public relationships, which made it recognized as a truly great national factor in conservation. Mather's greatest contribution is undoubtedly his leadership. He guided the concept of Federal protection and administration of parks and monuments from the wilderness of public indifference into the ordered sanctity of a priceless national asset to be jealously guarded. To the many millions of visitors who annually enjoy the areas administered by the National Park Service there can be no question of the desirability of keeping them inviolate, but this national philosophy did not develop overnight. A crusader such as Mather was needed to bring about this chore of mass education.

The story of how all this was accomplished is a very human one. It is packed with incidents that made history, and Mather had associates whose names mean much to all nature lovers.

I have enjoyed this book and consider it the best all-around presentation of the work of the National Park Service and the men who have made it what it is.

HAROLD E. ANTHONY

WILDFLOWERS. HOW TO KNOW AND ENJOY THEM

------ by Samuel H. Gottscho

Dodd, Mead and Co., $2.75
192 pp., 225 photos (103 in color)
48 line drawings

THIS pocket-size book is planned to give the reader the knowledge to identify and enjoy wildflowers. It can be easily carried and consulted by the nature lover who needs an introduction to the plant life of the eastern United States.

The author is a well-known photographer, and the book is planned to get as much as possible from his competence with the camera. The grouping is by color rather than botanical relationships, and for many persons this approach is interesting and effective. He knows his wildflowers, too, so the wedding of art and fact is a happy one.

The forepart of the book gives a general background for its use, sets forth enough botany to explain the terms used, tabulates by seasons the most obvious species and where they will be seen, and comments briefly on the names of flowers and on some of the most prominent plant families.

Then the reader comes to the topic of flower colors, and the basis for the color plates is established. A color chart, ranging through yellow (orange), pink (red), and blue (purple), has associated a few well-known flowers as examples of each shade. The color plates are arranged in separate sections: the blue flower section, the yellow, the white, and the pink flower sections. These sections include pictures of typical environments and a generous supplement of black-and-white photographic half tones.

There is a plea for the conservation of wildflowers, and a list of books on wildflowers, both current titles and those out of print. A few pages on hints for the photography of wildflowers may be taken as coming from an expert.

It is a pity that the publisher has not kept pace with the competence of the author. The color plates were first published by *Woman's Day* and made a pleasing impression upon this reviewer. Perhaps the first run took the bloom from the rose, but regardless of the reason for it, the color plates in this book average poor for color rendition and for detail.

HAROLD E. ANTHONY

BIRDS OF GREENLAND

----by Finn Salomonsen, Drawings by Gitz-Johansen

Ejnar Munksgaard, Copenhagen,
$9.00, 159 pp., 19 plates

VOLUME II of this handsome monograph is larger than the first part, which was reviewed in NATURAL HISTORY for November, 1950. There is no title page or other front matter, the text beginning with page 159 and continuing through page 348. It covers the life histories of Greenland grouse (several races of a single species, the rock ptarmigan), plovers, snipes, phalaropes and their relatives, skuas or jaegers, gulls, and the arctic tern—in all about 30 distinct forms of birds. This offers a clue to the fullness of the biographical accounts. The one on the ptarmigan alone fills 24 quarto pages of the bilingual (Danish and English) text.

There are 19 plates reproducing Gitz-Johansen's vivid—in some cases almost lurid—watercolors. These, like the illustrations of Volume I, are not likely to appeal to ornithologists schooled in a realism that demands the limning of every feather outline. To the writer of this review, however, they continue to be a welcome departure from a fixed tradition, even if the Danish artist has at times been almost too determined to cling to a starkly primitive idiom. Regardless of any crit-

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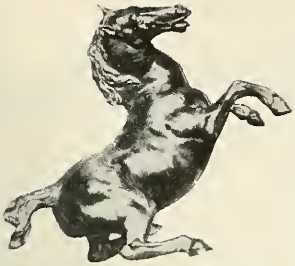

HORSES

THE STORY OF THE HORSE FAMILY IN THE MODERN WORLD AND THROUGH SIXTY MILLION YEARS OF HISTORY

by GEORGE GAYLORD SIMPSON

This non-technical and highly readable history of a fascinating and inexhaustible subject reveals the horse against the broad framework of the history of the earth and its life.

Dr. Simpson stresses the animal itself, not its use—an animal that has profoundly influenced man's social and economic development. He has taken the horse as an introduction to the understanding of all animals —classification, the relationships between their structures and ways of life—the meaning of fossils, the principles of evolution.

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American Breeds and their Forerunners
A Horse of Another Color

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PART THREE: *Horses and Evolution*
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With appendices for places where fossil horses may be seen and for further reading.

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icism that may stem from that fact, his color is pure and the plates convey the needed impression of birds in a stern but glowing arctic environment. The prevailing weakness of bird illustration is that it is wishy-washy—a sin that can never be charged against Gitz-Johansen!

Dr. Salomonsen has written adequate life histories, as thoroughgoing as current information warrants. The seasonal movements, reproduction, and moult of Greenland birds are satisfactorily linked up with what has been learned from experimental studies on the hormone cycle of related species. There are excellent accounts of arctic ecological relationships, including full records of the birds' natural enemies and food organisms. It is surprising to learn that the subsistence of the knot in Greenland is extremely high in vegetable content. As regards food in correlation with season, the author points out that the ptarmigan selects a high-protein diet in spring and early summer but one rich in vegetable oils throughout the months of subzero weather. Nor do the ecological studies exclude the native human bird-hunting population, the "Greenlanders," which seems to be the term invariably applied by Danes to the Eskimo citizens of their democratic kingdom.

Among other bits of interesting biological information are Salomonsen's reports on the strong incubating proclivities of male shore birds. The female purple sandpiper, for example, apparently leaves all such duties to her mate, a fact that forms a behavioristic link between the sandpipers and their relatives, the phalaropes, which have evolved even further in feminine emancipation.

R. C. M.

SEXUAL BEHAVIOR IN PENGUINS

-----------by L. E. Richdale

Univ. of Kansas Press, Lawrence, Kansas.
$5.00, 316 pp., 22 plates,
5 graphs, 1 map

THE title of this book, although much in the current vogue, might be misleading. It is really a scrupulous and quantitative effort to analyze practically every aspect of the behavior of the yellow-eyed penguin of New Zealand. It is fortified, however, by correlative data from other kinds of penguins and a number of sea birds of distinct groups, such as the petrels and albatrosses. Furthermore, earlier research on a wide range of animal behavior has been duly considered. It is only in relation to highly formalized penguin actions that Mr. Richdale has needed to create a new terminology more or less exclusively applicable to the subjects of his investigation. These terms include "sheepish look," "throb," "excited shake," "open-yell," "half trumpet," "kiss-preen," "glare," etc.

Continued on page 384

What are the chances of man not becoming extinct?

FALL OF THE SPARROW

by JAY WILLIAMS

***Introduction by* Stanley Edgar Hyman**

Darwin wrote about the origin of species; Jay Williams has written about their extinction.

One of the most engaging and witty books ever written on the subject, *Fall of the Sparrow* is the story of why certain species have vanished and why others are threatened. It is also concerned with such intriguing topics as the origin of legendary creatures and the probable end of Man.

During the past 2,000 years, at least 106 species and subspecies of mammals have disappeared from the earth, and untold numbers of other animals are probably now about to say farewell. Mr. Williams describes the sad fate of, among others, such species as the dodo, the sea cow—and the Tasmanians.

What happens when the delicate balance of nature is upset? What are the dangers of over-specialization and over-protection? What have conservation societies been able to accomplish—sometimes in the wrong direction? These are the serious themes underlying Mr. William's entertaining presentation. His answers are clear and incisive, and their impact is staggering.

Fall of the Sparrow is a book that will have special appeal for those interested in wild life. It will prove rewarding for those equally interested in human life.

Illustrated by
RICHARD TAYLOR

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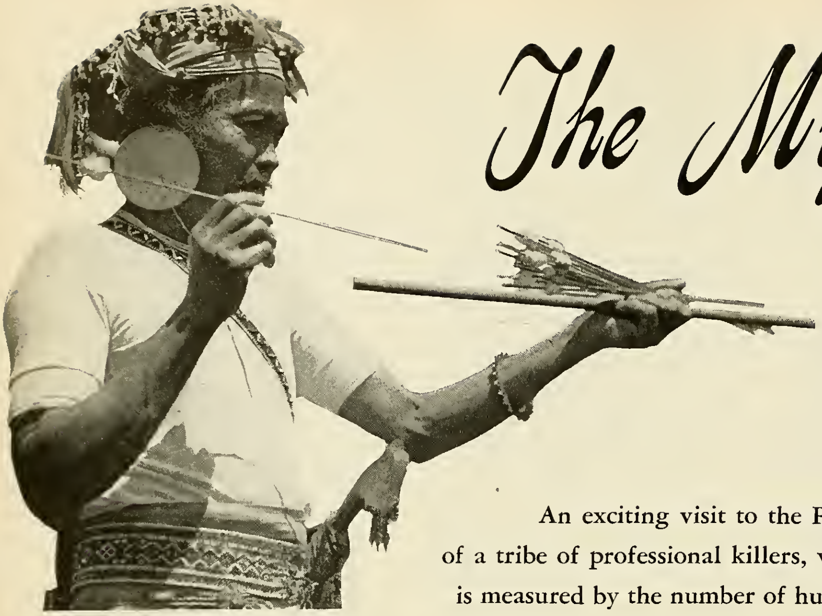


The Mysteriou

# of th

An exciting visit to the Philippine Island home of a tribe of professional killers, where a man's prestige is measured by the number of human lives he has taken

▲ PUTTING A DART into a blowgun. The tuft of cotton fills the bore snugly so that a puff drives the dart a great distance. These darts are sometimes poisoned

By Willard Price

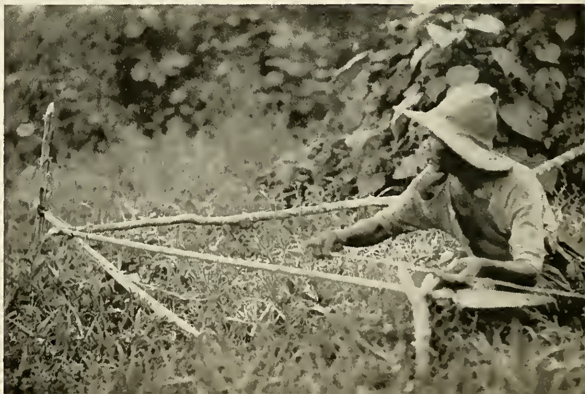
All photographs by the author

THE word "unexplored" was challenging. It was lettered over certain parts of the map of the island on which we now found ourselves. The island was Mindanao, southernmost and second largest of the 3,141 islands of the Philippines, and the time was shortly before the Japanese invasion of that archipelago.

Residents of the port city of Davao told us why these regions were unfamiliar to map makers. They were the home of professional killers. The Bagobos had developed intertribal assassination into an art. Even near the city there were occa-

▲ CATCHING A SONGBIRD. A bird is being tethered to a stick that is wrapped in black gum. Another bird of the same kind will be attracted and caught on the stick. This is a yellow and black bird with a pink bill known as a *soliyo,* which is esteemed as a songster

➤ A MECHANISM for spearing animals. When an animal trips over the cord, a trigger is released, and the spear is driven forward by the bent sapling. This *balatik,* as the implement is called, is now forbidden, because many people were accidentally killed



Land
Bagobos

sional killings, in spite of all that the Philippine Constabulary could do to stop them.

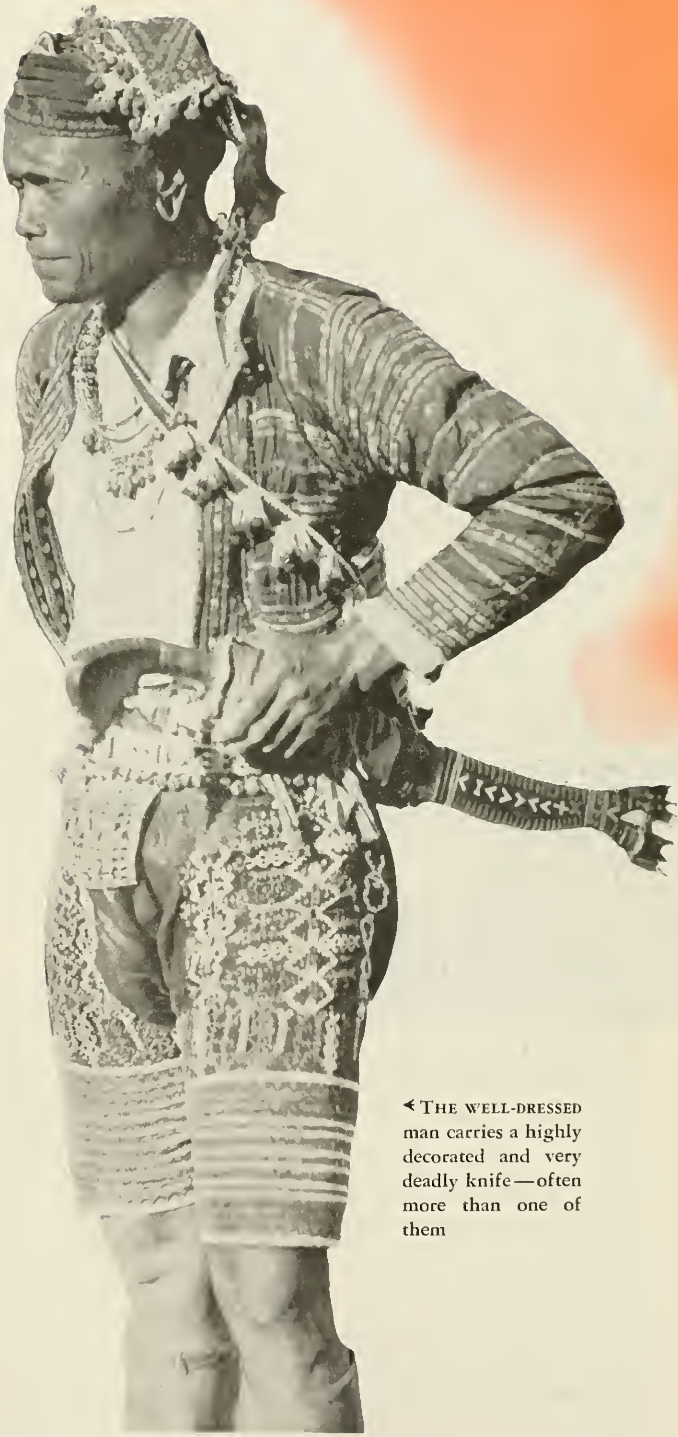
I had long since learned that popular accounts of tribal savagery are likely to be exaggerated. I went to a man who should know—Captain Romulo Dey of the Philippine Constabulary.

"I must go back to Melilla on the edge of the Bagobo country and can take you along if you wish," he said. "There, at least, you will be perfectly safe."

So my wife and I journeyed with the Captain to Melilla, vaguely hoping that when we got that far we might find a way to go farther.

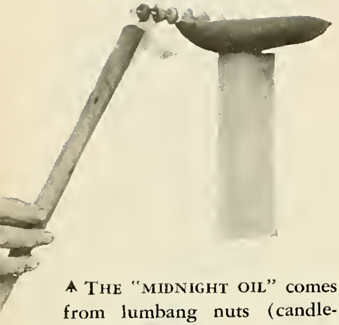
There was nothing ominous about the jungle we passed through. It was not somber and mysterious but well penetrated by sunlight and full of fruit trees. These grew wild, and their fruit belonged to anyone who would pick it. With refreshment all about us, it was not necessary to carry much food. We had only to decide whether we would prefer papayas, guavas, bananas, coconuts, or "the king of fruits," the durian, which has the double distinction of being one of the worst-smelling and best-tasting fruits in the world.

Rising above the other trees were the baletes, which begin as clinging vines and become towering giants. A seed dropped by a bird in the branches of some tree develops into a parasitic vine so small and weak that no self-respecting tree could take it seriously. But the vine grows

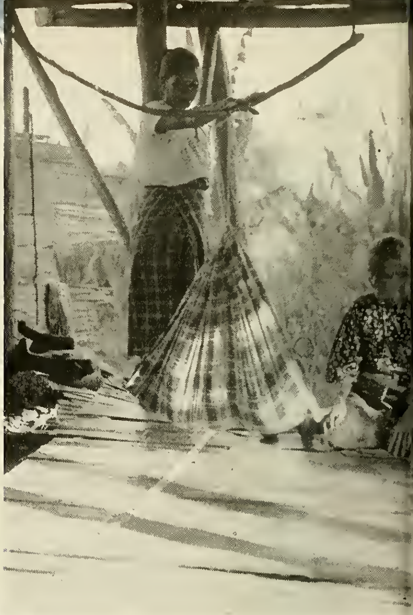


◂ THE WELL-DRESSED man carries a highly decorated and very deadly knife—often more than one of them

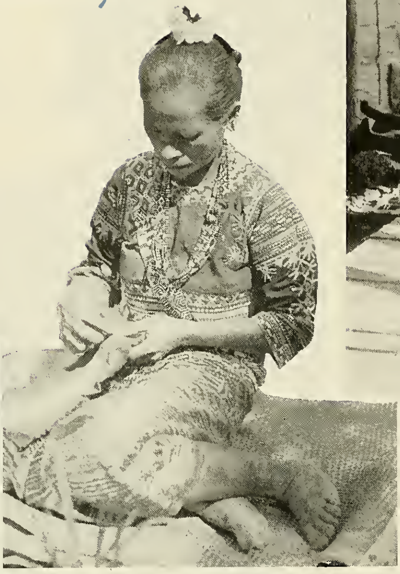
Home life



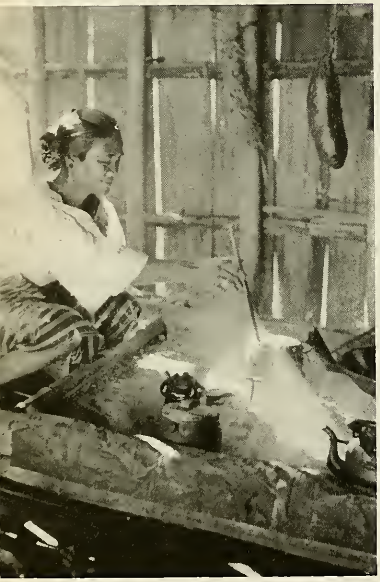
▲ THE "MIDNIGHT OIL" comes from lumbang nuts (candlenuts, in English). Several of the nuts are strung on a sliver of bamboo and laid on a stand. One nut burns down and then lights the next one



▲ A CRADLE made of a skirt hun from a bamboo pole. If the child i fretful, the cradle is not rocked bu jiggled up and down



▲ THE WOMAN of the house may spend months making one beadwork garment



◀ SIX INCHES of dirt serve as a stove, and several fires can be made on it. The walls are of hollow bamboo trunks split and flattened into boards

apace, moving down to root itself in the ground, and up to smother the trunk and all the branches with its powerful ropes and heavy leaves. Its host gradually dies and rots away; and in its place is the vine that has become a tree, perhaps twice as large in height and girth as the original. It rises above nearly all other trees of the Mindanao forest.

The better part of the day was needed to walk from the nearest motor road back through the woods to Melilla. Finally the Captain stopped and said, "This is it."

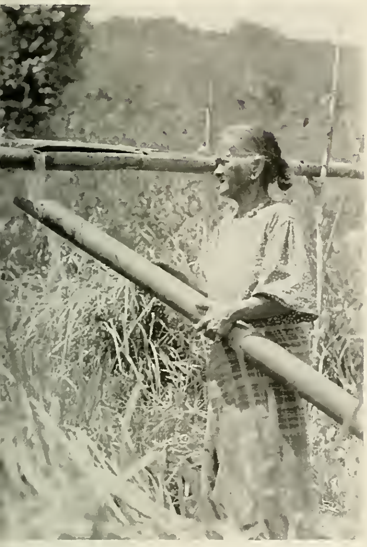
We looked about. There was no sign of a house. We stood in a small clearing with nothing but jungle about us.

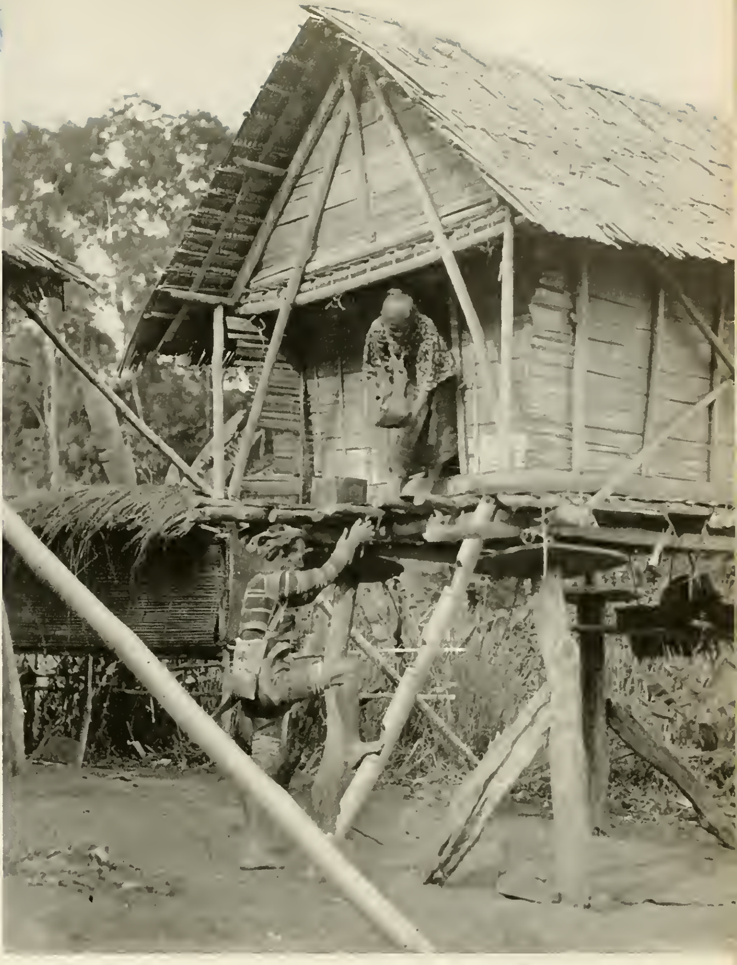
The Captain enjoyed our astonishment. "A Bagobo village is not a village in the ordinary sense," he said. "The Bagobos never put their houses close together on a street. They prefer privacy. Each man conceals his house in the jungle close to his own small fields. And you can never be sure where to find a man's house because, when his little farm is overrun by cogon grass, he abandons it, clears a new spot in the forest, and moves his house."

While we could see no one, others quite evidently saw us, for heads came poking out of the jungle, and we were presently surrounded by the first Bagobos we had seen. They looked as if they had been costumed for a festival. These were no primitive savages but a people with an elaborate though strange culture. They weren't satisfied with loincloths and sunshine; they were fully clothed in brilliantly-colored garments covered with intricate designs in embroidery and mother-of-pearl. Some of the jackets were so completely covered by the iridescent disks that they flashed in the sun like coats of mail. Only a people with remarkable artistic ability and tireless industry could have made them.

Evidently it was the fashion that the teeth must be black and filed to fine points. The lips were red with betel juice. The women wore flowers in their hair, ivory disks in their ears, and strands of beads under their chins. The men wore jacket and breeches and two belts—one for the breeches and the other for an assortment of highly decorated and deadly knives. Bracelets fitted

INSTEAD of a bucket, the Bagobo uses a ngth of bamboo closed at one end. The ater main is also bamboo





▲ A **STORAGE HOUSE** for grain and other foods. A notched bamboo pole makes a convenient ladder

with small brass bells encased their wrists. Their long hair was wound into a coil on top of the head and decorated with tassels and bells. Large ivory disks hung from their ears. They were fragrant with perfume. But any notion that they were softies was dispelled by a single glance at their fierce and sometimes murderous faces.

The most disquieting face of all belonged to a big fellow who did not wear the usual multi-colored costume but whose coat, trousers, handbag, and handkerchief were all blood-red.

"He is a magani," Captain Dey told me. I promptly averted my eyes. I had heard of the magani—ritualistic killers – and wished to have nothing to do with them.

But the magani continued to take an uncommonly keen interest in us and presently pushed his way through the crowd to our side. He spoke to Captain Dey in his own tongue, and the Captain translated.

"His name is Ranon. He wants us to go to his house."

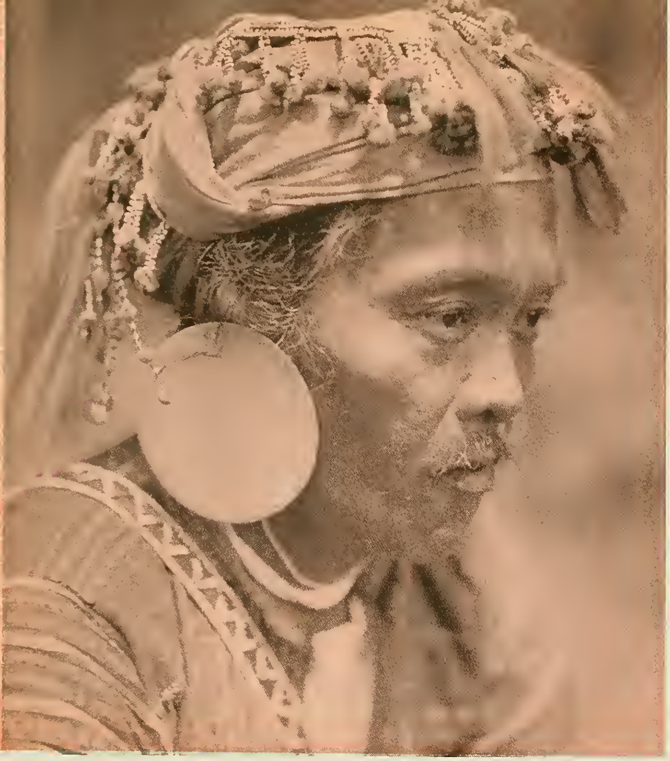
"Thank him and tell him that we are otherwise engaged."

"I'm afraid we can't do that. It wouldn't be wise to antagonize him."

We followed Ranon out of the clearing and into the jungle. Presently we came to some posts, and looking upward we saw that they supported a house among the trees fully fifteen feet above the ground. A notched log slanted upward to the front door. Following Ranon, we climbed up this pole, which vibrated precariously under our weight. At night, said the Captain, the pole was drawn up like the drawbridge of a castle, and the house was fairly safe from attack.

We entered the house and found ourselves in a sort of bamboo cage that trembled at every step. The roof was of nipa thatch, and the walls were of bamboo planks seamed with cracks through which the sunlight filtered in. The bamboo floor was also half cracks, so that one had the sensation of walking on air. The Bagobos considered it essential, Captain Dey explained, to have cracks in the floor so that it would be possible to keep an eye out for prowlers underneath the house. The cracks also provided ventilation and allowed escape for smoke from the cooking fire.

The man, woman, and boy who lived in the house were relatives of Ranon, whose own house we were to see later in a remote village.



↑ **Ear ornament of ivory.** The disc has an inner flange an inch and a half in diameter, which fits a hole of that size in the lobe of the man's ear

↓ **Fine strings** of beads hang from ear to ear, where they are attached to plugs inserted in the lobes

We stayed for dinner. It consisted of fresh fish caught in a nearby pool, a delicious paste of banana and sweet potato, and an unexpectedly palatable dish of grasshoppers and rice.

The room was getting dark. I wondered what the Bagobos used for artificial light. There were no electric bulbs, no oil lamps, no candles to be seen.

Our hostess went to a cupboard and took out a sliver of bamboo on which were impaled six nuts. They were candlenuts, rich in oil. The string of nuts was laid in a shallow dish, and the nut at one end was ignited. When it had nearly burned out, the second nut caught fire. The six nuts were good for about three hours of light.

The floor was our chair and the floor was our table, and our fingers were the knives and forks. Ranon leaned toward me with what was supposed to be a kindly grin, but his expression looked inexpressibly evil in the sputtering light of the candlenuts. "In my house I have a table," he said proudly, the Captain translating. "I am a great magani. That is why I wear red."

"Just what is a magani?" I asked.

The Captain undertook to explain. The gods of the Bagobos are jealous gods. They demand sacrifices, and chickens will not do. The sacrifices should be human. A magani is one who kills in order to appease the gods. He does not kill his own people but makes raids on other wild tribes. He may occasionally take a Chinese or Japanese farmer and, more rarely, an American.

"We are trying to stop it," said the Captain, "but we have to work slowly. After all, the Constabulary is not a large force. We are outnumbered many times over by the tribesmen. And we have to show some respect for tribal customs, even though they seem barbarous to us. Ranon has declared that he is done with killing, and we are giving him a chance to prove it. He is, as you might say, on probation."

"What is the significance of the red costume?"

"There are magani of the first, second, third, and fourth degrees. A first-degree magani is one who has taken only three lives. He is not allowed to dress all in red but may wear the red kerchief or *tangcolo* on his head. When he has killed a total of six, he may put on the red coat. After he has killed nine, he is entitled to add the red pantaloons. If the number of victims is ten or more, he may wear black instead of red."

"And since Ranon is all in red that means he stopped at nine?"

"I doubt it. I'll ask him."

He calmly put the question, and Ranon as calmly replied. It seemed unbelievable that a killer would quietly tell a police office how many murders he had committed.

"He says he has killed eleven."

"Then why doesn't he wear black?"

The Captain put the question to Ranon.

"He says that when he began serving his gods he made a vow never to wear black until he had killed fifteen. But he promises he will not try to fill out the quota. He says he likes red. I tell him he had better be content with it or he will be wearing another sort of uniform—in San Ramon Prison at Zamboanga."

It was time to sleep. The flame of the last candlenut was dying out. The night wind gently rocked the bird cage of a house. We lay down with the others, all fully dressed, on the sleeping platform, which extended across one end of the room. The hard wooden bed and the presence of the red killer should have been enough to keep us awake. But thanks to the day's walk, we were asleep in ten minutes.

The next morning I proposed that Captain Dey take us farther into the back country.

"I'll go with you up to Migdayas," he said finally. "But I've never been beyond that. If you want to go farther, perhaps Ranon will guide you."

➤ A VENERABLE BAGOBO

⮝ OLD MEN, lacking teeth, pound the hard betel nut in a mortar of silver inlaid with brass. The costume is elaborately beaded

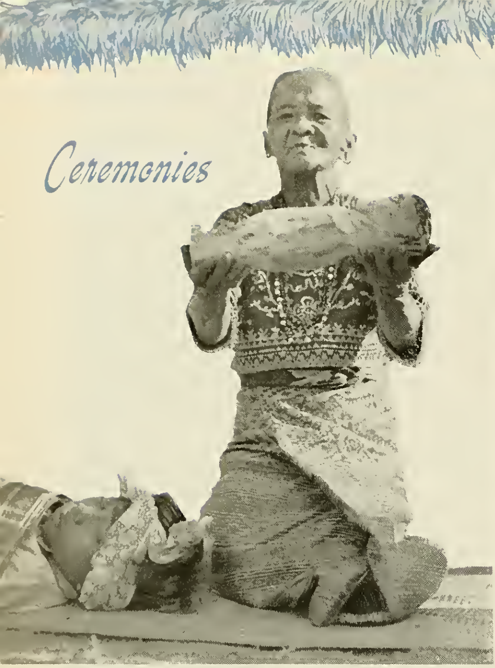
The suggestion was rather distasteful. We had hoped to leave Ranon in Melilla, but he insisted upon accompanying us.

Ranon soon proved useful. He saved my life from the deadly poisoned spear of the *balatik*, a contrivance that releases a weapon when an animal in the path trips on a vine which has been rigged as a trigger. He warned us of leaf-covered pits, at the bottom of which were sharpened bamboo stakes to kill any animal that might fall in. It was necessary also to watch for a "deadfall," a heavy log so arranged that it would drop on anything passing beneath. Ranon warned my wife in time to avoid putting her hand on a dangling snake which looked like a heavy vine. He slashed a large vine, the rattan, with his bolo, and we drank the cool water that welled out of it.

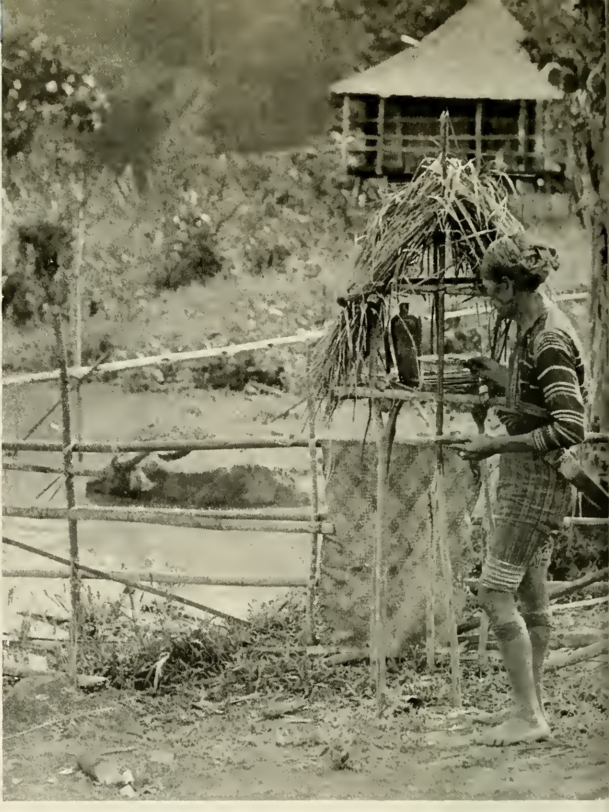
The trail was very steep and hard, and even Ranon's assurance that we were the first Americans to travel it did not make it any easier. We were climbing from the coastal lands toward a high ridge. There were no more fruit trees. Instead we passed great apitongs and lauans nearly 200 feet tall. Big dapdap trees covered the ground with crimson petals. Now and then we saw a heron, startlingly white against the shadows of the forest. There were dozens of other birds. Most of them had deep resonant voices quite different from the soprano of birds of temperate climes.

A little before sunset we came out on the ridge with a good view of Mt. Apo, lazy smoke rising from

Ceremonies

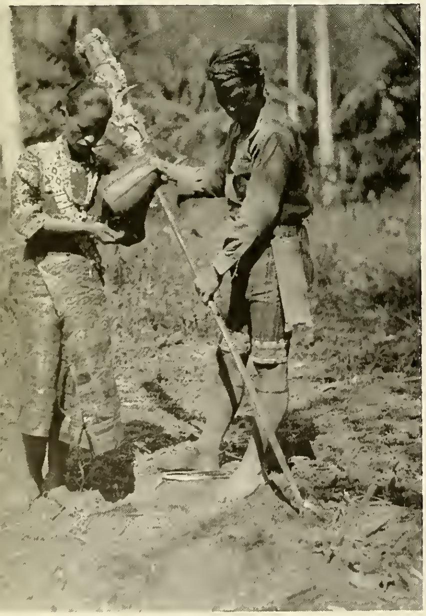


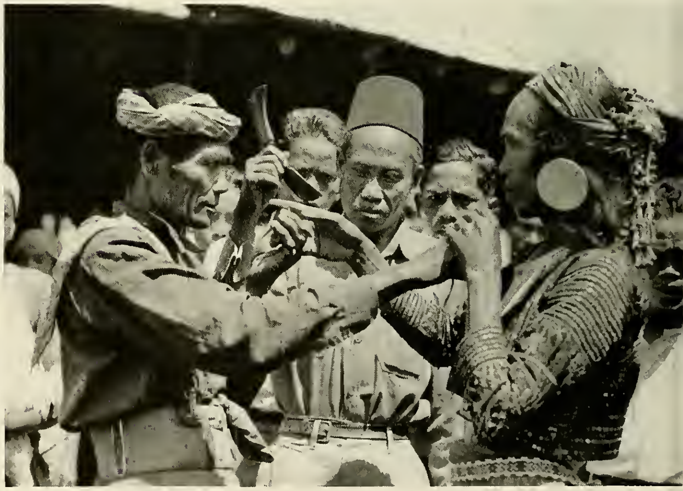
▲ A SORCERESS, or *mabalian,* is offering the spirits a roughly carved doll in place of the boy whom they have made sick



▲ BECAUSE a girl in the house is ill, offerings are placed on this roofed stand, or *tambara*—betel nut, bananas, and a bottle of water

▼ THE MAN goes down the field using the *palakpak* to turn up the soil, and the woman follows, sowing the seed. At the upper end of the *palakpak* is a bamboo clapper, which makes a loud sound every time a hole is dug, thus pleasing the spirit guarding the field





▲ THE BLOOD COMPACT. This ceremony is performed by men of different tribes, as when a Moro comes to live among the Bagobos. The Moro *(left)* and the Bagobo *(right)* suck each other's blood after the *datu,* or chief, has cut their fingers its sulphur-coated crater, and Ranon announced that we were in the village of Migdayas. He took us to the house of the *datu,* chief. Ranon spoke to him in a patronizing way, for this *datu* was just a first-degree magani, having taken only five lives.

The inside walls of his house were hung with weapons of the chase and weapons of war: spears, knives, bows, and blowguns. Across one end of the room was the sleeping platform, raised about a foot from the rest of the floor. Food was stored in baskets hung from the rafters to keep it away from ants, rats, and snakes. There was a loom for turning hemp from the abaca plant into clothing. Moderns who want all the new gadgets might have envied the *datu* his dishwashing machine. It was simply a bamboo cage outside of the window. You put all your dirty dishes in it, and the daily rain washed them clean.

In front of the house was a *tambara,* a pedestal bearing a dish of fruit as an offering to the spirits. Every Bagobo house had one. The Bagobos are animists and live in constant dread of the spirit world.

Captain Dey had to turn back; he had duties in Davao. "Will you go back with me, or do you want to continue with Ranon? He has offered to take you on a week's journey through the hills. Then he will bring you out at Malagos. That is where he lives. I'll have another Constabulary officer meet you there."

If Captain Dey thought this was a fit and proper arrangement, who were we to question it? We followed the man in red into the hills. The truth is, we were beginning to like him. He always seemed to know the right thing to do in an emergency. In every village he was respectfully and somewhat timidly received, and even the *datus* took his orders. Although he could not speak any language we could understand, he taught us much about the life of the Bagobos. Captain Dey had told him of our curiosity concerning tribal customs, and he took pains to stage demonstrations so that we might see these customs for ourselves.

We saw how a Bagobo wedding was conducted. It was easier than marriage at Gretna Green or Las Vegas. The bride and groom sit on a mat facing each other. Each feeds the other a handful of rice. They bump their heads together and are man and wife.

The groom pays the bride's father one copper gong, one horse, and a betel box. But the bride's mother, in turn, presents the groom with one copper gong for himself and ten skirts for his wife.

A man may take as many wives as he wants and can afford, but he may not take a second until the first has borne a child or has proved to be barren. For every additional wife brought into the family, the husband must pay his first wife a substantial sum. Thus the first wife usually does not object to the advent of new wives, provided they recognize her as the lady of the house and obey her.

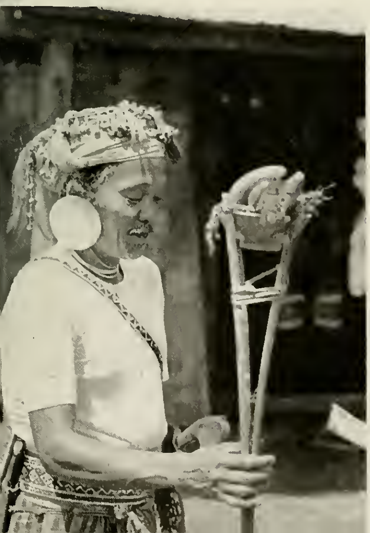
Divorce is easy. A plate is broken to signify that the marriage is ended.

We were shown how the teeth are filed to sharp points and how they are blackened with a deposit of charred bamboo. An ear-piercing ceremony was staged for our camera. A hole is made in the ear, into which a tightly coiled coconut leaf is introduced. The constant expansion of the springlike leaf makes the hole larger and larger until a package of cigarettes can be carried in it, or a small parcel. One *datu* wore ivory discs four inches in diameter in his ears.

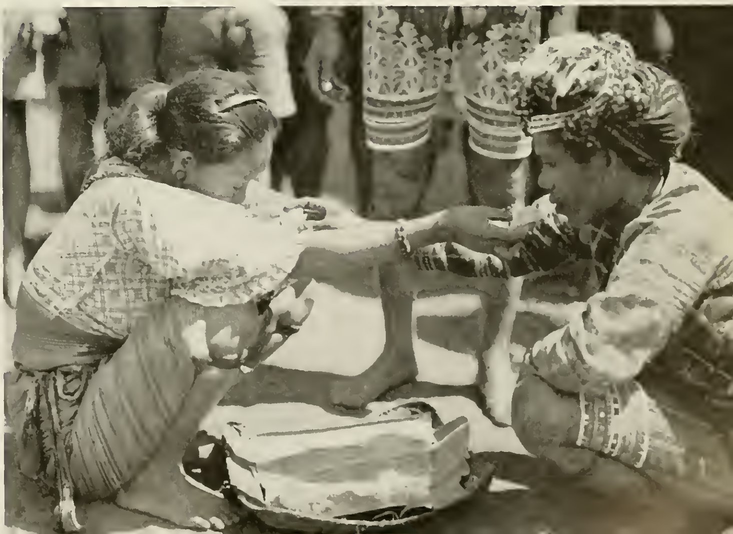
We saw the process of tattooing: the skin is cut with a knife, and the ashes of resin from the lauan tree are rubbed into the cuts.

A remarkable ceremony is the

Continued on page 383



▼ THIS TAMBARA, which is placed upright in the ground, supports a dish filled with fruits or grains as an offering to the spirits



▼ BAGOBO WEDDING. Two portions of rice are laid on a banana leaf in a winnowing basket. Each gives the other a bit of rice, then they bump their heads together and are married

The MURDER of a Landscape

Shortsighted exploitation poisoned and denuded the hills, and 100 square miles of southern countryside have become an almost hopeless desert

By Edwin Way Teale

▼ A WOUND THAT REFUSES TO HEAL. The protective vegetation has been broken, and the hills are being washed away

Edwin Way Teale photo

ALL that morning, in the April sunshine, our road had carried us through mountain forests, green and lush. Then, like a pleasant dream sliding into a nightmare, the country swiftly changed.

The forest thinned away. The trees grew smaller, became stunted, disappeared altogether. Bushes shrank and vanished. Grasses died away. Blighted land replaced the forest. All around us, dead hills, red, raw, ribbed by erosion, stood stark in the sunshine. Hardly two miles from dense woodland, we were in the midst of a moonscape on earth. Ahead of us, the road led through a land of desolation, through a man-made desert, through a hundred square miles of poisoned earth.

We were in the southeast corner of Tennessee, in the Ducktown Desert of the Copper Basin. Chattanooga lay 70 miles to the west behind us, Gatlinburg and the Great Smoky Mountains, more than 100 miles to the north and east along the Tennessee-North Carolina line. The Ducktown Desert occu-

US TVA photo

▲ **In the midst** of lush mountain forests, the Ducktown Desert shows only scattered patches of grass. Erosion has begun and will continue unless plant cover can be re-established to hold the soil in place

pies a position where three states, Tennessee, North Carolina, and Georgia, join. The boundaries of the three commonwealths meet near an old church on a desolate elevation, which bears the ironical name of Pleasant Hill.

All the hills were pleasant here less than a hundred years ago. What had happened? What had left these slopes around us sterile and almost lifeless? What had produced this desert in the midst of a green landscape? We pulled in for gasoline at a filling station, perched like an oasis on a barren hilltop. Our questions were an old story to the proprietor. Ten thousand times a year he had heard them. Bewildered tourists had interrogated him so often he had had a pamphlet printed in self-defense. From it and from other sources, we learned the history of this tragic area. It is a classic tale of land abuse. It is also, in its way, a murder story. For it deals, literally, with the murder of a countryside.

Until about 1840, Cherokee Indians occupied the land. Hardwood forests clothed the hills, and shaded brooks meandered toward the Ocoee River. Then General Winfield Scott, carrying out orders, rounded up the Indians and herded them west. White settlers moved in. Not far from the village of Ducktown, copper ore was unearthed and a scramble of fortune hunters began. The village boomed. It was, at one time, more prominent than either Knoxville or Chattanooga. It had a newspaper, *The Ducktown Eagle*, before the Civil War. During the war between the states, copper from Ducktown played an important part in keeping Confederate armies in the field.

At first, ore was hoisted to the surface with a hand-operated windlass, and the bellows of the smelting furnaces were powered by old-fashioned water wheels. The refined metal was packed on mules 70 miles to the railroad at Dalton, Georgia. By 1853, however, gangs of laborers had cut a road through the Ocoee Gorge to the west, and, for decades thereafter, iron-shod wheels of heavy wagons rolled behind straining horses to carry copper 40 miles to the railroad at Cleveland, Tennessee. We had followed the same route, now U. S. Highway 64, that morning as we passed through the Cherokee National Forest.

It was a custom, in the early days of copper mining, to roast the ore under large log fires before placing it in the furnace. This eliminated the sulphur. As the Ducktown area developed, the demand for wood mounted. One company alone consumed 20,000 cords of wood and 500,000 bushels of charcoal annually. Convict labor was pressed into service chopping wood. Axes rang all day long. The forests receded in an expanding circle. At the same time, the flaming piles of wood, sending up their

▼ **Near the outer edges**, cows graze on rapidly shrinking pastures

Edwin Way Teale Photo

showers of sparks night and day, ignited the surrounding grass and bushes. Behind the receding forests, in times of dry weather, almost daily fires swept the earth bare of vegetation. Always it came back. But always it was consumed again.

Even worse than ax or fire, however, was a third enemy of the vegetation. This was the clouds of sulphur dioxide gas that rose from the roasting piles and hung in a noxious pall over the hills of the Copper Basin. It attacked the grass and plants and bushes that remained. It damaged the breathing pores of the leaves. Evergreen needles became brown. Leaves on deciduous trees turned white, red, red-brown, or yellow. Growth rings in the trunks of the dying trees became thinner with each succeeding year.

Different kinds of vegetation respond in different ways to the poison of this gas. Blue violets, for example, when enveloped in sulphur dioxide, lose their blue and turn green. Larch trees are highly susceptible to the fumes in spring but more resistant in fall. Hemlocks, white pines, and sycamores are easily killed by the gas; red maples, white oaks, and black gums are more resistant to it. On still days, when there is fog or high humidity, the damage is greatest. Vegetation on hillsides facing the roast yards and smelters of the

Edwin Way Teale photo

▲ WATER IS NOT LACKING in this desert. The topsoil is gone, and nothing will take root on the steep slopes. Clear evidence that in land care an ounce of prevention is worth a pound of cure

▼ THE GRAND CANYON probably looked like this in its infancy. Unless checked by plantings or by nature's slow repair, the destruction will continue as long as water runs downhill

US TVA photo

▼ DOWNSTREAM, where the slope is more gradual, silt is deposited. Poor conservation practices are often costly far beyond the areas directly affected. The Ducktown Desert is causing dams to silt up

US TVA photo

Copper Basin was first affected by the fumes.

In addition to attacking the growing plants, the sulphur dioxide entered the soil, either directly or by absorption or indirectly by atmospheric precipitation or through absorption by vegetation. This tended to increase the acidity of the soil.

By the end of the roast-yard era, that is, about the turn of the century, all the trees were gone from the region, and all the lower forms of vegetation were going. The hardy sedge grass, which had withstood the attack longest, was giving way before the endless burnings. The protecting skin of the earth, vegetation, was being sloughed away. Patches of bare soil expanded. Those twin instruments of erosion–the chisel of the rain and the hammer of the wind–did the rest. The climatic extremes and the heavy Appalachian rainfall of the region speeded the destruction. Swiftly the fertile topsoil slipped away down Potato Creek, down Bushy Creek; millions of tons of it washed away as silt down the Ocoee and the Tennessee, down the Ohio and the Mississippi. Left behind, like a red-flayed carcass, were the raw hills of sterile undersoil.

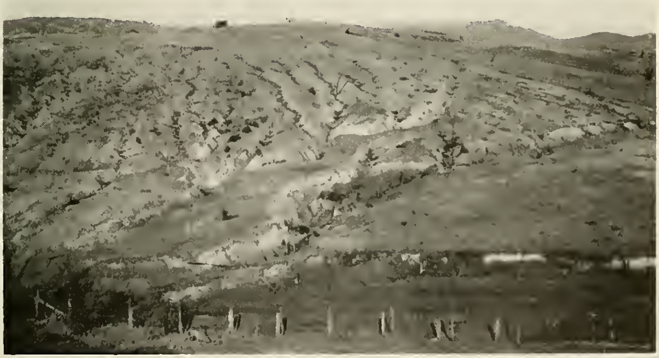
They rose around us as far as we could see. They formed a nightmare region, symbolical of all the erosion-ridden fields, all the dust bowls man has created on this continent. Only a few minutes before, we had stopped by a mountain spring amid woods to listen to a hooded warbler sing high in a yellow birch. Small birds had been everywhere. The forest edge along the roadside had swarmed with them. There, life was at an exuberant peak. Here, it seemed almost entirely absent. We heard the far-away jingling song of a field sparrow on one of the patches of sod that still clung to an eroding hillside. We saw three English sparrows picking on the bare ground before a clapboard house that huddled disconsolately on a treeless plain, its roof tinted pink by dust from the desert hills. But we saw, in all that accursed red land, only one wild songbird among the many millions then migrating north.

This bird was drinking from a small streamlet of clear water that flowed down the groove of a deep gully. Even there, where water was plentiful, the sterile soil supported hardly a single plant. Beside the rill, bending down, then lifting its head high as it drank, was a white-throated sparrow. Its crown was brilliantly streaked, its throat patch snowy, the yellow before its eye vivid in the intense sunlight. In this bleak setting, this migrant, pausing on its journey to damp, mossy, shaded northern woods, looked incomparably beautiful.

Near the edge of the desert, where the patches of sedge grass were larger, half a dozen cows wandered about, feeding as best they could on the sparse pasturage of these shrinking islands in a sea of

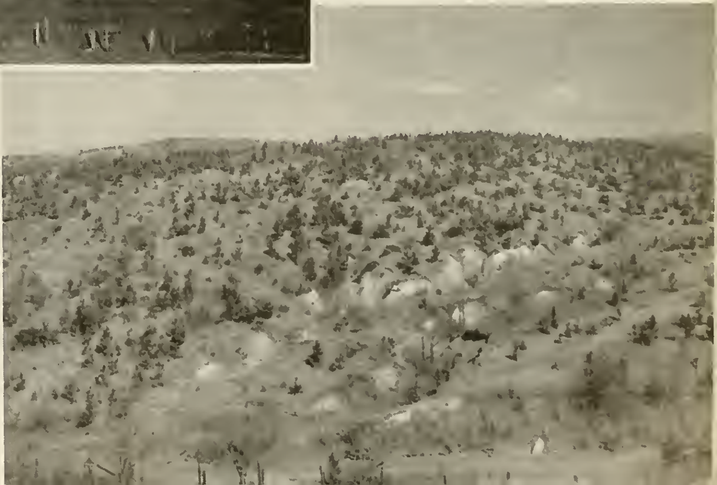
▲ CCC PLANTING CREW. Many grasses and trees have been tested

US TVA photos



▲ AN AREA in which reclamation work had been begun in November, 1941. Prior to planting, check dams are built in gullies and straw mulch is spread

➤ THE SAME AREA six years later. Definite progress is noted, but the work is expensive and slow. Most of the area remains a desert. As yet, man has not been able to undo the damage he has done



erosion. A few meadowlarks, I was told, still return to nest on these patches that hang like pieces of sloughing skin to the hillsides. During the time nestlings are being fed, the larks fly from patch to patch, as though among the islands of an archipelago, in their search for insects.

But insects, like other forms of life, are scarce in the Ducktown Desert. We saw a few small blue butterflies, azures of spring, drifting along the roadside. And once, when we stopped on a hilltop to view the dead landscape around us, we discovered minute red ants swarming over the red soil. They were racing wildly, bumping into each other, milling about a small dead caterpillar a few inches from the anthill. Here was a great prize in this austere land. Never have I seen ants of a similar size running with greater speed. The untempered glare of the sun beat down upon them. Its heat shifted them into high gear.

I laid down a thermometer beside the anthill. Its mercury slid swiftly upward until it touched the 115-degree mark. What would a midsummer reading be? Without the balance wheel of vegetation, the bare hills of the Copper Basin heat up rapidly under the sun and cool off just as rapidly with the coming of night. Between midafternoon and night on a September day, the thermometer may fall as much as 35 degrees.

In other ways, the disappearance of vegetation has modified the local climate in these badlands of the South. During summer months, for example, the heat is usually greater at the eastern edge than at the western edge of the area. The prevailing winds are from the northwest. They flow across the vast griddle of bare ground and are heated as they go. Moisture in this red soil also evaporates at an abnormally rapid rate. When scientists of the U. S. Forest Service made tests, they found that evaporation on the naked hills was five times as great as on the floor of the neighboring forest—as long as the moisture lasted.

As we drove past the great smelter of the Tennessee Copper Company at Copperhill in the heart of the Ducktown Desert, we looked up and saw lofty stacks discharging their fumes high in the air above us. After years of litigation, the U. S. Supreme Court, about 1907, ruled that the copper companies of the area were responsible for controlling the sulphur dioxide they had been pouring into the air. In consequence, special equipment was installed to recover sulphuric acid from the smelter smoke. The result is that, today, the Copper Basin is the largest producer of sulphuric acid east of the Mississippi. To aid in dispersing what fumes remain in the smoke away from the immediate neighborhood, higher smokestacks were also built. One of the stacks that towered above us was 400 feet high!

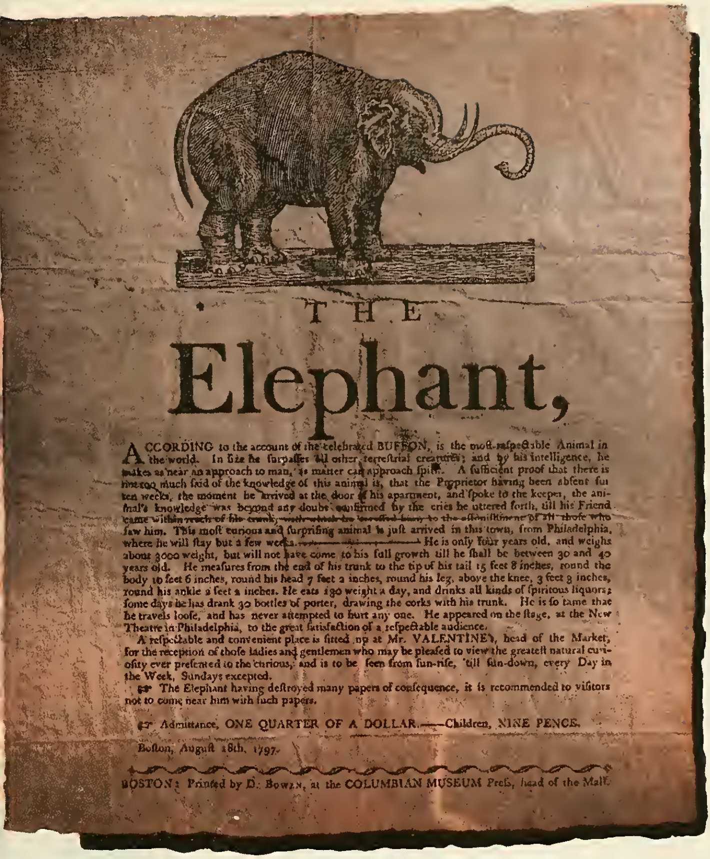
Sulphuric acid—which played such an important part in the destruction of plant life here and was wasted for so many years—is now one of the strategic materials of which we are critically short. So it would have been good conservation for more than one reason to have reclaimed it from the start. We have not yet learned the lesson of Ducktown. Hundreds of factories all over the United States are still discharging noxious materials into the air that could be reclaimed at an eventual profit.

Can the Ducktown Desert ever come back? Can this moonscape ever be made fertile again? Extensive researches were carried out in the area before the Second World War by the TVA and the Tennessee Copper Company. The Tennessee Valley Authority was concerned because erosion among the naked hills threatened a rapid silting up of some of its dams. Under the direction of the Civilian Conservation Corps, hundreds of thousands of trees were planted. Check dams, formed of brush and hogwire, were set up in the gullies. Hilltops were mulched to retain moisture and prevent runoff. From Africa, Japan, the Mediterranean countries, plants were brought to Tennessee and tested as cover for the poisoned hills.

In nearly a hundred different plots, scattered over the area, the scientists tried out plants with strange names and remote origins—kudzu, Sudan grass, trailing Lespedeza, Italian rye grass, crown vetch, Bermuda grass, bird's-foot deervetch, Bahia grass of the Pensacola strain. And, one by one, the research scientists crossed them off the list. A single plant, *Eragrostis curvula*, or Weeping Lovegrass, a native of South Africa, proved useful in the completely denuded areas. Of the innumerable trees tested, two kinds, both native to the region, proved best. Black locust showed itself most effective in the gullies and pitch pine on the eroded hillsides.

Before World War II virtually brought to a halt efforts at reforestation, more than 2,400,000 trees had been set out. We looked around us. A few small clumps of pines huddled together amid the waste. These were the trees that had survived—an almost negligible number. The vast majority had succumbed to the insurmountable conditions of life in this desert produced by man. So far, man has failed to undo the damage he has done. The problem remains unsolved. Unless more effective aid is forthcoming from man, the desert has only the long hope of Nature's slow repair.

We drove on through this land no spring could awaken. Here no showers could stimulate probing roots and rising stems. Here no sun could contribute to the production of chlorophyll. The hills were stricken, and the land lay dead. But as we drove on, grasslands reappeared. Small trees, at first widely scattered, grew more numerous. They gained in size. Then we were in woodland once more, the desert left behind. All the lushness of spring surrounded us as we climbed on winding roads through mountain country to the east. But in our mind's eye, all the way and during the days that followed, we saw the bare ribs of the earth, that strange, dead, red earth, that spreads away over the poisoned hills of the Ducktown Desert.



THE

Elephant,

ACCORDING to the account of the celebrated BUFFON, is the moſt reſpectable Animal in the world. In ſize he ſurpaſſes all other terreſtrial creatures; and by his intelligence, he makes as near an approach to man, as matter can approach ſpirit. A ſufficient proof that there is not too much ſaid of the knowledge of this animal is, that the Proprietor having been abſent for ten weeks, the moment he arrived at the door of his apartment, and ſpoke to the keeper, the animal's knowledge was beyond any doubt confirmed by the cries he uttered forth, till his Friend came within reach of his trunk, ~~with which he careſſed him, to the aſtoniſhment of all thoſe who~~ ſaw him. This moſt curious and ſurpriſing animal is juſt arrived in this town, from Philadelphia, where he will ſtay but a few weeks. He is only four years old, and weighs about 3000 weight, but will not have come to his full growth till he ſhall be between 30 and 40 years old. He meaſures from the end of his trunk to the tip of his tail 15 feet 8 inches, round the body 10 feet 6 inches, round his head 7 feet 2 inches, round his leg, above the knee, 3 feet 8 inches, round his ankle 2 feet 2 inches. He eats 130 weight a day, and drinks all kinds of ſpiritous liquors; ſome days he has drank 30 bottles of porter, drawing the corks with his trunk. He is ſo tame that he travels looſe, and has never attempted to hurt any one. He appeared on the ſtage, at the New Theatre in Philadelphia, to the great ſatisfaction of a reſpectable audience.

A reſpectable and convenient place is fitted up at Mr. VALENTINE'S, head of the Market, for the reception of thoſe ladies and gentlemen who may be pleaſed to view the greateſt natural curioſity ever preſented to the curious; and is to be ſeen from ſun-riſe, 'till ſun-down, every Day in the Week, Sundays excepted.

☞ The Elephant having deſtroyed many papers of conſequence, it is recommended to viſitors not to come near him with ſuch papers.

☞ Admittance, ONE QUARTER OF A DOLLAR.——Children, NINE PENCE.

Boſton, Auguſt 18th, 1797.

BOSTON: Printed by D. Bowen, at the COLUMBIAN MUSEUM Preſs, head of the Mall.

◄ OLD BET in Boston, 1797. Visitors were advised not to go near her with valuable papers, because she had destroyed many of them

THE CROWNINSHIELD ELEPHANT

The surprising story of Old Bet, the first elephant ever to be brought to America

By GEORGE G. GOODWIN

Associate Curator of Mammals
American Museum of Natural History

NATHANIEL Hawthorne, in his introductory note to *The Scarlet Letter*, wrote: "Here on the granite steps of the Custom House in Salem, Massachusetts, you may greet the sea-flushed ship master just in port with his vessel's papers under his arm in a tarnished tin box." When he wrote this he may have been thinking of his own ancestors, who for over a hundred years had braved the salt spray and gales on ships that sailed the high seas to India and the Orient to bring back precious perfumes, spices, silks, tea, ivory, and other rare products.

From the pages of one of these old logbooks, as well as from sea captains' letters that have lain forgotten for more than a century and a half in the archives of the Essex Institute, comes an interesting story that was front-page news in its day. This story definitely fixes the date when the first living elephant set foot on American soil. It was on April 13, 1796, and the port was New York. It is the story of an enterprising sea captain who had something of the spirit of the great P. T. Barnum beneath his rugged exterior.

The logbook, now faded and stained with brine, was written in the handwriting of one Nathaniel Hathorne, the father of Nathaniel Hawthorne, the author, who later added the "w" to the family name. He must have been an officer on board the Private Armed Ship *America.*

The captain of the ship *America*, was Jacob Crowninshield, who came from a family of shippers that ran the firm of George Crowninshield and Sons of Salem. There were five brothers, all in command of ships in trade with India about this time.

The *America* set sail from Calcutta for New York on December 3, 1795. Nothing of interest appears in Nathaniel Hathorne's Logbook until Wednesday, February 17, 1796, at St. Helena. "This day begins with moderate breezes . . . latter part employed in landing 23 sacks of coffee . . . took on board several pumpkins and cabbages, some fresh fish for ship's use, and greens for the elephant." Below is written in large letters "ELEPHANT ON BOARD." On February 24, the *America* stopped at the island of Ascension, where the men got several turtles and saw a large sea lion. The last page in the Log records the sighting of Long Island at 7:00 P.M. on April 11. From the times and distances, it can be estimated that the elephant must have been landed in New York on April 13, 1796.

The voyage had been a remarkably calm one. Except for a few squalls, no storms were recorded. The next important information we have concerning the elephant seems to be a clipping from a New York paper dated April, 1796. It reads: "The Ship *America,* Captain Jacob Crowninshield of Salem, Massachusetts, Commander and owner, has brought home an elephant from Bengal in perfect health. It is the first ever seen in America and is a great curiosity. It is a female, two years old."

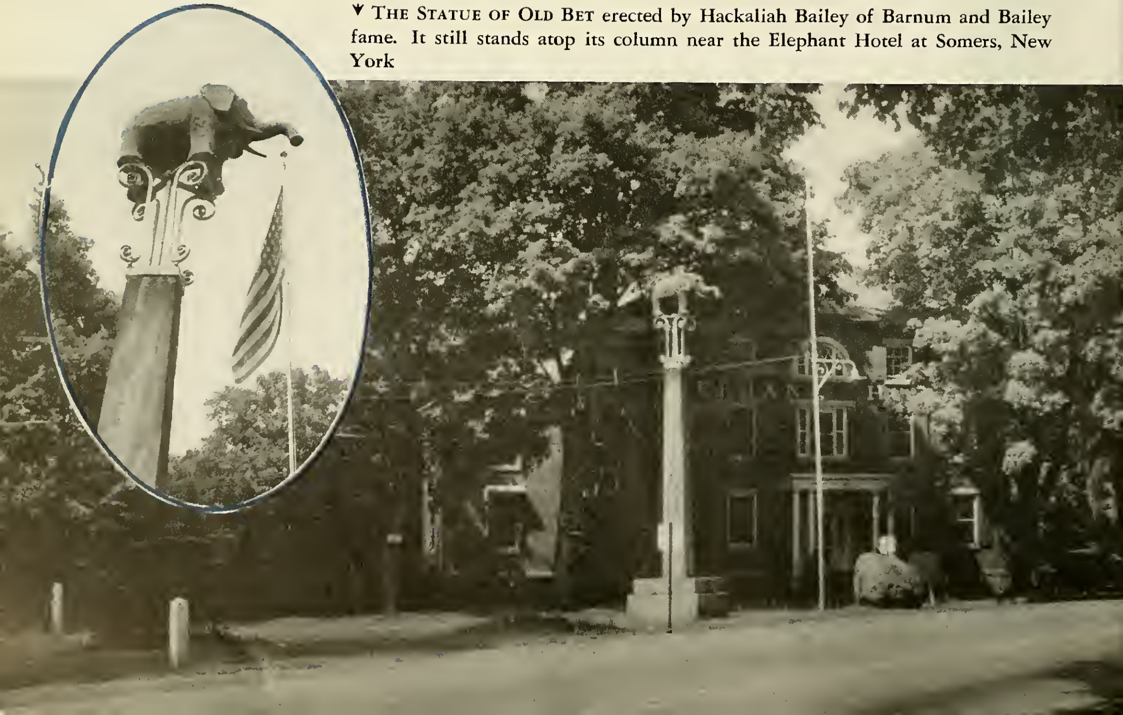
From a pile of letters, sea journals, and charts that have lain securely ensconced in an old sea chest of John C. Crowninshield for well over a century, we can learn something of the human side of the venture. Jacob Crowninshield writing in India to his brothers John and George in command of the *Belisarius* on the way to India on November 2, 1795, says: "We take home a fine young elephant two years old, at $450.00. It is almost as large as a very large ox, and I dare say we shall get it home safe, if so it will bring at least $5000.00. We shall at first be obliged to keep it in the southern states until it becomes hardened to the climate.

"I suppose you will laugh at this scheme, but I do not mind that, will turn elephant driver. We have plenty of water at the Cape and St. Helena. This was my plan. Ben did not come into it, so if it succeeds, I ought to have the whole credit and honor too; of course you know it will be a great thing to carry the first elephant to America."

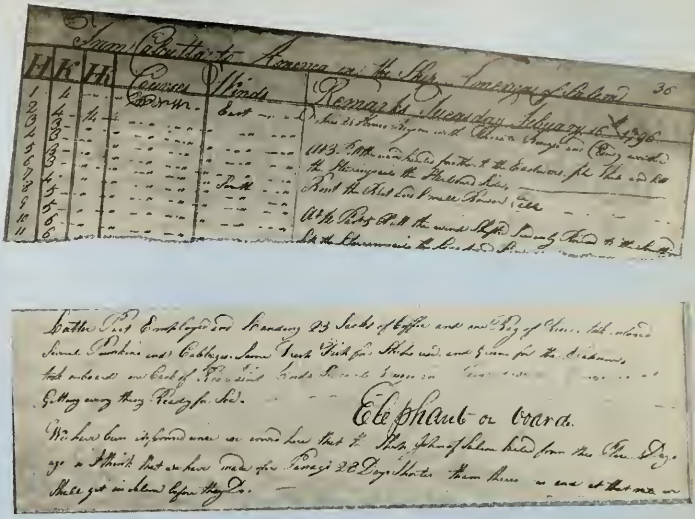
The fact that the *America* was the ship that brought the first elephant to the United States is corroborated in "An Account of the Private Armed Ship *America* of Salem by B. B. Crowninshield," also in the Historical Collection of the Essex Institute. This record states that the ship arrived from Calcutta at New York in April, 1797, and mentions that the animal sold for $10,000. He had the facts right except that the year should have been 1796.

Various writers on early American events fail to agree on the date of the landing of the first elephant in America. They put it all the way from 1776 to 1833. Much of the confusion seems to be due to the fact that there have been many ships named *America.* The one that carried the elephant was a French vessel bought for Elias Hasket Derby at the Isle of France by Jacob Crowninshield in 1794. She was insured in March, 1795, and was taken over by Jacob and Benjamen Crowninshield, who immediately sailed for Calcutta. She returned to New York April 13, 1796, and was sold in the early summer.

A summary of the travels of the elephant can be traced through newspaper reports and public notices. The first account in *The Argus and Green Leaf Advertiser,* which on April 23, 1796, and in many succeeding issues advertised the first elephant as being on exhibition in New York at the corner of Beaver Street and Broadway. The next record is from a handbill dated August 18, 1797, advertising the exhibition of the elephant at Boston. On September 5, 1797, the Salem *Gazette* states that, "The elephant will leave town in two days



THE STATUE OF OLD BET erected by Hackaliah Bailey of Barnum and Bailey fame. It still stands atop its column near the Elephant Hotel at Somers, New York



↑ Nathaniel Hawthorne's Father, evidently an officer on Board the *America,* wrote this entry in the ship's logbook. His handwriting grew large when he referred to the first elephant ever to come to America

and go to Marblehead for three days." On September 12, the *Gazette* carried this announcement: "The elephant will be exhibited in Beverly at the new house opposite Captain Goodridge's."

The elephant appears to have been taken south about this time for the winter, and according to harbor reports was brought north to Philadelphia in April, 1798. (This entry evidently misled a writer in the Chicago *Inter-Ocean* in October, 1895, who claimed this date for the arrival of the first elephant in America.) Mr. E. Savage, one of America's earliest showmen, exhibited the elephant in Boston on June 25, 1804, and on July 3 it was again in Salem and on view at the Sun Tavern.

"Old Bet" seems to have been the name that was applied to this elephant, and the animal was eventually acquired by Hackaliah Bailey, who got together the first American circus and became the Bailey of Barnum and Bailey Circus fame. He was originally a farmer at Somers, N. Y. At this point, the record becomes a bit confusing, perhaps because there may have been another "Old Bet" fifteen or twenty years later. Or, as suggested above, repeated returns of the original elephant from the South may have been heralded by careless reporters as the arrival of the first elephant ever to reach America.

Suffice it to say that the Bailey Circus consisted of four wagons, a trained dog, several pigs, a horse, and of course the elephant. Bailey toured the country for several years with Old Bet as his chief attraction, and when he returned to Somers in 1824, he built the hotel that is still standing, known as the Elephant Hotel. He also promoted what was called the Zoological Institute.

The diarist William Bentley saw Bet at the Market House in Salem on August 30, 1797, and described the elephant in detail. From his narrative there is no doubt that this was Crowninshield's elephant.

What, we ask, became of Old Bet? Bentley was at the exhibit of 1816 when an elephant was killed, and he mentions the killing of the poor beast by a crank in Maine who felt that the animal was taking money from the public. "A boy was induced," he writes, "to secrete himself as she passed on the road and to test the story that her hide was bullet proof. He did so, the shot hit her in the eye and instantly killed her." However, the Boston *Herald* of December 30, 1895, claims that Old Bet was maliciously killed in Rhode Island in 1816. This is based on a statement in a catalogue of Barnum's American Museum in New York, where Old Bet's remains were viewed by hundreds of thousands of people. If this was Old Bet, she was apparently twenty years old when killed. It is questionable whether a boy with the ammunition of those days could kill a twenty-year-old elephant by shooting it in the eye. Certainly death would not be instantaneous. To complicate matters further, a writer in the Boston *Herald* on December 22, 1895, claimed that Old Bet was killed in North Carolina in 1827. The stories of the Maine and/or Rhode Island killings, though apparently true, may have applied to another elephant.

In any case, Bailey erected a monument to Old Bet on the green in front of his Elephant Hotel at Somers, New York, about fifteen miles east of Peekskill. The image is carved in wood and stands on a shaft of dressed granite. Here, one can still see one of the most remarkable statues in existence–the figure of an elephant on a tall column.

In 1922, about a century after Old Bet's death, "Old John," the star performing elephant of the herd of Ringling Brothers, Barnum and Bailey Circus, took a wreath on his trunk and placed it on the monument of Old Bet at Somers Village, while "the children had a holiday and sang the *Star Spangled Banner*."

Other elephants came and went. There seem to have been additional Old Bets; there was also a famous big fellow named Mogul, and, of course, Jumbo. But the original Old Bet was the first to arrive in America and the only elephant to have been given such a memorial.

COMING

In the near future, readers of Natural History *will have opportunity to read the dramatic story of Jumbo, the most celebrated elephant that ever lived.*—Ed.

Forster photo

▲ THE STAHL SITE, where the ancient houses were found, lies just one-eighth of a mile off U. S. Highway 395, the main road between Los Angeles and Reno

Exploring the Past

America’

Discovered by an amate

continent w

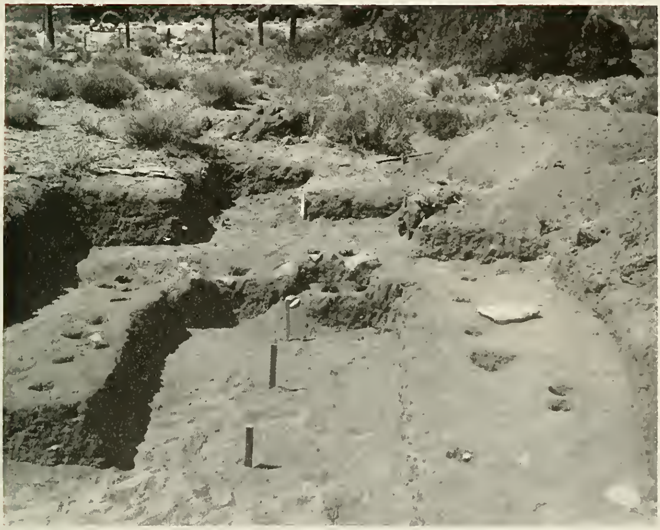
▼ U.C.L.A. STUDENTS excavating the ancient village. In the background are the tents occupied by the expedition

ldest Houses

aeologist, the oldest known dwellings on the American
by a people who may have found abundance in a region now arid

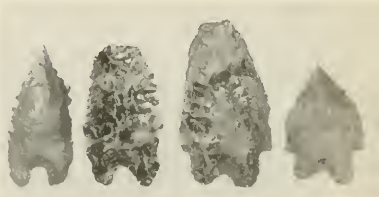
By Andrew Hamilton

▲ **Mark R. Harrington**, veteran explorer and authority on the Indians of the Southwest, photographing the inside of the near-by Stahl site cave



▲ **Excavated pinto house**, rectangular with rounded corners. The holes originally contained poles that supported the roof

▼ **Pinto points**: spear points made of obsidian and chalcedony. Such points were the first clue that an ancient Indian tribe had once lived at the south end of Owens Valley in California



In more than one detective story, the sleuth, when asked how he found the criminal, says, "I just imagined where I'd go if I were the chap. I did, and there he was."

That's roughly how one of the most exciting archaeological finds in the United States—the famous Stahl site near Little Lake, California—was discovered. It contains what are said to be the oldest houses in America, and it will probably yield archaeological treasures for years to come.

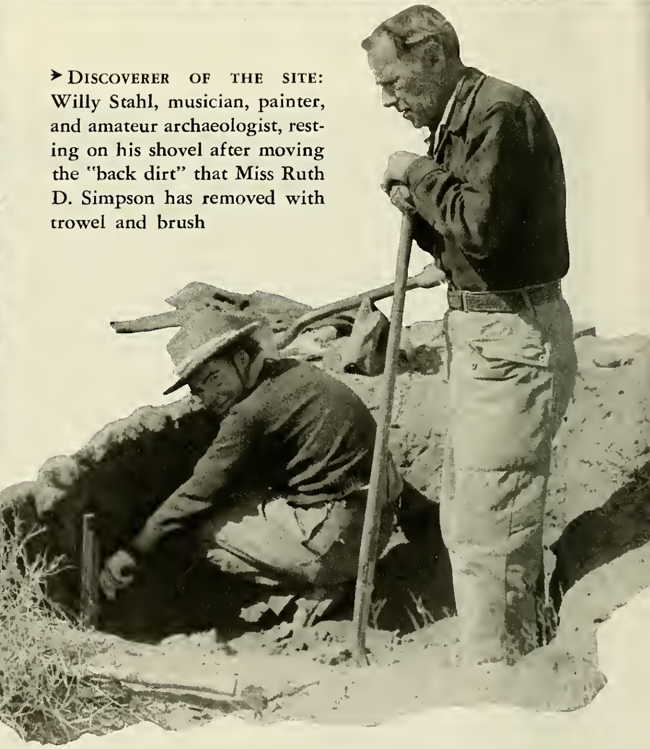
Most people think of Indians as living in buffalo skin tepees or caves, as the plains tribes and the cliff dwellers of the Southwest actually did. But there were many tribes that dwelled in crude huts built out of branches or logs with well-defined walls and roofs.

The Stahl site is about 180 miles north of Los Angeles, flanked on the west by the southern tip of the snow-capped Sierra Nevada and on the east by the barren desert mountains beyond which lies Death Valley. It contains evidence of three of the most primitive Indian houses ever found. They are believed to be not less than 3000 years old, nor more than 10,000.

The site of these "oldest houses" was discovered one winter day in 1947 by Willy Stahl, Los Angeles musician, painter, and amateur archaeologist. The great semiarid trough of Owens Valley, in the southern end of which the site lies, receives almost no rainfall, because clouds traveling east over California

➤ **Inside the Stahl site cave,** just below the surface, where objects of later Indian origin were found. Note the stone pestle at the rear, just where it was found

⮟ **Miss Ruth D. Simpson,** Assistant Curator of the Southwest Museum at Los Angeles, at work with a 5-inch trowel—"the largest tool we use," Mr. Harrington said when offered a bulldozer



➤ **Discoverer of the site:** Willy Stahl, musician, painter, and amateur archaeologist, resting on his shovel after moving the "back dirt" that Miss Ruth D. Simpson has removed with trowel and brush

deposit their rain and snow on the heights of the Sierra before they reach this valley. Indeed, this is the location of Mary Austin's famous book, *Land of Little Rain.*

However, Stahl knew that the Owens Valley, following the last glacial era, had been fertile and well watered. Trees, grass, and flowers grew plentifully where now only cactus and creosote bushes struggle. Game had probably been abundant, and without doubt, he reasoned, early Indian tribes lived in the valley.

Climbing to the top of a barren volcanic lava flow, Stahl gazed out over the desert. He could trace an ancient river bed and a dry "fossil" waterfall. "If I were an Indian, I'd camp on that knoll below the waterfall," he decided.

Down the steep cliff he climbed and hiked over to the low mound he'd picked out. He dug a few holes—none of them more than three feet deep—and found some black obsidian spear points and some crude stone scrapers.

"All it took was a little imagination and an amateur's interest in archaeology," Stahl said later.

When he returned to Los Angeles, Stahl looked up an old friend, Mark R. Harrington, white-haired curator of the Southwest Museum and a leading expert on the Indians of the Southwest.

Harrington examined Stahl's obsidian spearheads with great interest.

"Pinto points," he declared.

Pinto refers to the Pinto Basin near Twentynine Palms, 200 miles southeast, where William R. and Elizabeth Campbell in the early 1930's first found spear points and stone implements on the bank of another dry river. The Campbells' report, entitled *The Pinto Basin Site* and published by the Southwest Museum in 1935, has been called a real milestone in American archaeology.

The Campbells had suggested that the Pinto culture existed not only in the area around Twentynine Palms, but in the entire stretch of desert that lies between California and Nevada—running as far north as the Owens Valley. Since then it has been traced from northern Nevada to Lower California and east to New Mexico.

Stahl's handful of spear points and scrapers seemed to bear out this theory.

"If Pinto points are to be found near the surface, the deposit on which they lie should be as old or older," said Harrington. "Perhaps we can excavate a campground of this early American Indian culture with all its features in place."

On March 8, 1948, Harrington, Stahl, Miss Ruth D. Simpson, and a small group of volunteer diggers returned to the site where the original discovery had been made. One of the most faithful volunteers who worked with this original party was a busy orange grower, Mr. Ritner J. Sayles. The spirit of the game got into his blood, and Mr. Sayles has been a member, at least part-time, of every expedition since.

For three months this Southwest Museum archaeological party crisscrossed the area with trenches, working enthusiastically even when the 110-degree summer sun made perspiration trickle down their noses. Using small hand trowels, nut picks, and paint brushes for the slow and painstaking excavating itself and shovels for removing surplus "back dirt," they trenched the sandy mound to a depth of from two to eight feet.

Almost every type of stone weapon or tool that the Campbells had found in the original Pinto Basin site farther south turned up in the Stahl site. There were nearly 200 spear points as well as hundreds of manos and metates for grinding acorns and seeds, scrapers for cleaning animal skins, and crude stone knives.

▲ **The Pinto Indians** lived in caves as well as houses, for their implements have been found in the rock shelter shown in this photograph

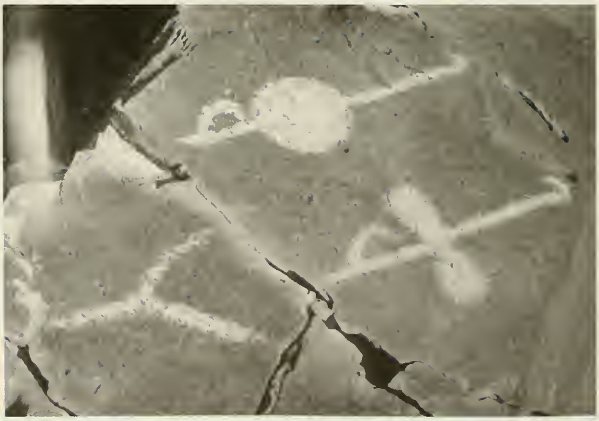
As each specimen was uncovered, it was carefully labeled and its exact location horizontally and vertically was noted. Later these specimens were taken back to the Southwest Museum, sorted, and classified. Like pieces of a jigsaw puzzle, when put in place they will give the archaeologists a fairly complete picture of the Pinto culture.

Most of the implements were made of obsidian (a glasslike rock), chalcedony (related to agate), or hard metamorphosed shale. The obsidian comes from an ancient quarry near by, which evidently supplied the Pinto Indians for miles around.

Because the Stahl site lies only one-eighth of a mile from U. S. Highway 395, one of the main traffic arteries between Los Angeles and Reno, there were frequent visitors to the diggings.

On one occasion, three well-dressed businessmen drove up to the site.

"We own a mine up the road a way," they said. We saw in the papers you were working, and we thought we'd offer you our bulldozer if you can use it."



▲ **Petroglyph** on rocks near the Stahl site illustrating an ancient Indian spear thrower used in hurling stone-tipped spears

Harrington thanked them for their offer and held out a five-inch pointing trowel:

"Here's the biggest tool we use."

Amateurs can either be a headache or a help to the professional archaeologist. The so-called "pot hunter," the vandal who goes in with scoop, shovel, and pickax, hoping to find a complete Indian earthenware jug filled with glittering gold or a skeleton wearing emerald and ruby jewelry, can often undo the serious archaeological work of years.

But the amateur archaeologist who appreciates what the professionals are attempting and takes guidance from them is often invaluable. Stahl was one of these. So were members of the Archaeological Survey Association of Southern California and anthropology students under the direction of Dr. George W. Brainerd of the University of California at Los Angeles who worked with Harrington at the Stahl site.

In fact, it was B. E. McCown, an engineer and amateur archaeologist from San Diego, who really discovered what are thought to be the oldest houses thus far found in North America.

With his wife Hazel and 22-year-old son, McCown volunteered to help excavate the Stahl site over the 1948 Fourth of July week end. He was assigned to remove the soil from Square A-5 (a square yard), and he lifted it out with the greatest care. First he troweled away about three inches of loose "blow sand," then some 10 or 12 inches of a more compact sandy material. Then came a darker, harder layer, blackened by the leaf mold of the long-vanished forest and the camp debris of the ancient people who had once lived on the spot.

Finally McCown reached a hard-packed dark stratum about 22 inches below the surface on which rested a very thin layer of sand. Brushing this away, he found that the hard layer was pierced by a circular hole, which was four inches in diameter and filled with softer material.

"What's this—an animal's burrow?" McCown wondered.

But when he uncovered three such holes, all the same size and spaced at intervals of 14 inches, he called to Harrington, "I think I've found something good!"

Harrington and the others gathered around McCown and helped to excavate squares adjoining the lucky A-5. A total of 14 holes were soon located, outlining what seemed to be the foundation for the north and west side of an ancient house. The east side was uncovered later.

This first early Indian house or hut measured some 13 by eight feet—about the same size as the tents used by the archaeological party. The entrance was either at the south or the east end, a common practice among Indian housebuilders.

"What the superstructure may have been, we have no way of determining," says Harrington. But as the posts were placed vertically in holes in the ground, we may guess that they terminated in forks supporting a flattish roof of poles covered perhaps with tules.

"The walls may have been willow wattle work, woven in between the poles. Possibly the roof and walls were plastered with mud. But of this we have no evidence one way or another. There was no floor except the hard-packed earth. No fireplace was located, although a deposit of burned bones lay near the hut."

To date, a total of three Pinto houses have been uncovered on the Stahl site. The second was circular in shape, and the third rectangular like the original discovery. Harrington is certain many others exist and will be uncovered by further excavating.

"There is no doubt that these houses were built and used in the Pinto period," he says. "Pinto points, grinding stones, and charcoal were found in and near the houses. And conversely, no modern objects appeared. Moreover, the earth that was excavated didn't appear ever to have been disturbed."

How old is Pinto? Archaeologists are still trying to gather evidence to answer this question. Most of them agree that the Pinto Basin people flourished at least 3000 years ago; other estimates go back to 10,000 years.

Previous to the discoveries of Pinto culture near Twentynine Palms in 1935 and Willy Stahl's find in 1947, the oldest known human habitations on the North American continent were the pit dwellings of the Basketmaker Period. These were built during the early centuries of the Christian era—less than 2000 years ago.

"That makes the Pinto houses, which must be at least 3000 years old, the oldest human habitation outside of caves thus far reported in North America," Harrington points out.

"However, we must not picture the Pinto people as living only in huts. They occupied caves also. This we know from our excavations in a small cave at the northwest corner of the Stahl site."

Pinto man was a rather primitive type of Indian. He made no pottery and knew no agriculture. In all probability he was a wanderer who hunted game and gathered berries, grass seeds, acorns, pine nuts, and roots—and was just beginning to learn to settle down and live in one place. His weapons were primitive spear throwers for hurling stone-tipped spears, because he hadn't yet learned the principle of the bow and arrow.

Although Harrington estimates that 300 or 400 Pinto culture Indians must have lived at the Stahl site, only a few human bone fragments have been found so far. Bones of food animals that once roamed the then green valley that is now sandy desert are much more plentiful.

"Now if we could find a complete human skeleton, that would be the real prize," says Harrington. "Spear points, scrapers, knives, post holes, and animal bones are all interesting to the archaeologist. But as Alexander Pope said, 'The proper study of mankind is man.' And until we find a human skeleton of Pinto Man, the story will not be complete."

Photo Department of Lands and Forests, Ontario

Photo by C. F. Brockman

The dawn patrol of the Douglas fir forests: A typical Spruce Budworm control crew with plane. The "enemy" is seen at left, the caterpillar of a three-quarters-inch moth, which is threatening some of our finest stands of timber in the Pacific Northwest

AIR BLITZ on the Budworm

By C. FRANK BROCKMAN

Scientific shock troops of the tall timber use new methods in combating a foe that threatens to devastate a rich area larger than the state of Delaware

PAUL Bunyan, if one believes the legends of the tall timber, was quite a man. He never faced a job too big or a problem too tough. With the aid of his faithful blue ox "Babe," he tackled and solved them all. But oxen have long since gone out of style in the logging woods, and even this hinterland Hercules would find his hands full if he were here today in the Pacific Northwest, faced with the problem of controlling the ravages of the most recent threat to the forests of this area–the Spruce Budworm.

The fabulous Paul might even be confused by the insect's name, for it is not a worm. Further, while it is occasionally seen on spruce trees when they are interspersed among more preferred ones, the spruce budworm has done no commercial damage to spruce in the Pacific Northwest. Its name is derived from its feeding habits in northeastern United States and Canada.

For the past several years this destructive forest enemy has taxed the energies, ingenuity, and intelligence of a large segment of foresters and lumbermen in Oregon and Washington, and still the job is incomplete. But the insect will have to be brought under control soon or the basic industry of the Pacific Northwest, upon which a quarter of a million people depend directly for their livelihood–an industry that supplies more than a quarter of all the forest products used by the nation–will be seriously hampered.

Reports of the Spruce Budworm Action Committee–made up of a group of leading foresters and lumbermen representing private, state, and federal interests–give a wide variety of statistics to show how urgent it is to control this pest.

Over two million acres of timberland, containing more than twelve million board feet of potential forest products, are affected. This area is considerably larger than the state of Delaware. And just as it stands in the woods–"on the stump"–the endangered timber is conservatively valued at 63 million dollars. Further, when one adds the costs of logging, manufacturing, and marketing, which contribute to the value of the finished products that could conceivably be derived from these infested stands, the figure balloons to over one billion dollars.

Even this does not indicate the full size of the monkey wrench that this little moth has tossed into the machinery of the Pacific Northwest forest industry. Most of the damage already done lies outside the higher quality timber zones, and the spruce budworm threatens to invade untouched forests of tremendous size and importance. The existing areas of infestation present a major threat to the sustained yield management of Northwest forest lands.

And don't overlook the fact that properly managed forest lands have values other than lumber production. The recreational utility of a forest damaged in this manner would obviously be impaired. Fire hazards and fire control costs on such lands would be increased materially, because extensive areas of lifeless snags form a veritable tinderbox from which could develop a series of major conflagrations. The danger of soil erosion, floods, and flood damage, and the impairment of water supplies—which in many sections of this region are barely sufficient to meet current needs—would be vastly heightened if extensive forest areas were laid waste. Such damage could easily mount to calamitous proportions.

Foresters and lumbermen have been aware of this threat. The spruce budworm has long been a destroyer of spruce and balsam fir in the northeastern states and Canada. From work carried on in those regions much has been learned that can help to solve the problem in the Northwest. Here, however, spruce is little affected. Instead Douglas fir, the most valuable northwestern timber tree, is the principal victim. To date, over one million dollars have been spent in a successful fight against the spruce budworm on a large part of the infested area. But the job is only partially completed. Maximum benefits derived from the efforts of the past several years depend largely upon the immediate completion of the control program in the remaining areas of heavy infestation.

The spruce budworm is known to have been present in the Pacific Northwest for many years, but until recently it has caused little damage or worry. True, minor outbreaks have developed on several occasions in the past, but they subsided before there were serious timber losses. In 1948, however, when the infestation in the Blue Mountains of northeastern Oregon attained dangerous proportions and gave no indication of abating, tests were made to determine the best methods of halting further damage. From these experiments evolved the methods used during the past two or three years, beginning with a "dress rehearsal" on two of the more critical infestations during the summer of 1949. In that year some 260,000 acres of forest land in the vicinity of Eugene and Mount Hood, Oregon, were sprayed by means of airplanes with a DDT-fuel-oil mixture. At a cost of $1.20 per acre, more than 98% of the budworm larvae, or caterpillars, were destroyed on the acres treated. The success of this program resulted in an intensification of the control activities in the summer of 1950, when nearly one million acres were similarly sprayed with even better results. The elimination of the budworm larvae was just as effective and the cost was reduced to about $1.06 per acre by virtue of better operational procedures. Further, in addition to regular control activities, experiments were conducted with various DDT combinations, as well as with other insecticides, which gave promise of even greater savings in the future.

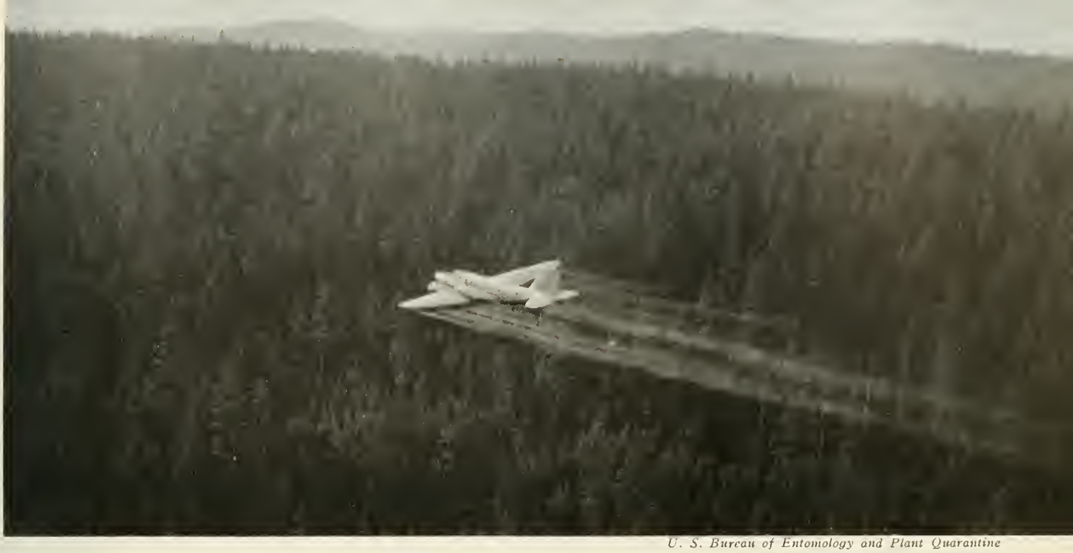
The spruce budworm, in the adult form, is a small, inoffensive looking gray-brown moth with a wing expanse of about three-quarters of an inch. Under normal conditions, it would pass unnoticed

Photo by C. F. Brockman

U. S. Bureau of Entomology and Plant Quarantine

▲ **Loading up:** pumping the DDT-fuel-oil insecticide into a tank in the remodeled forward cockpit of the Stearman plane

➤ **Beneath** the wing of this Stearman plane a row of backward-pointing spray nozzles have been installed for distributing the DDT mixture



U. S. Bureau of Entomology and Plant Quarantine

▲ A CONVERTED B-19 BOMBER on a nonmilitary mission. Note the spray pattern in the wake of the plane as it treats a pest-ridden forest with protective mist

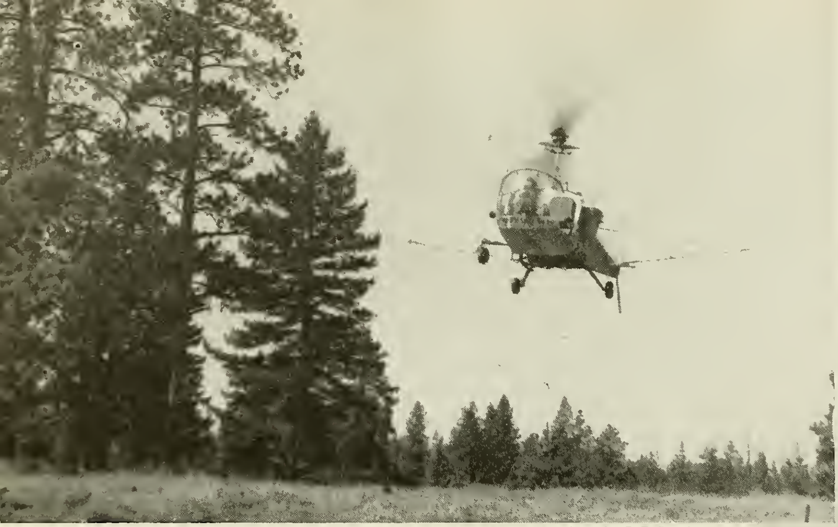
except by an entomologist familiar with it. But when, for some reason, natural controls are removed or overcome, the budworm develops to epidemic proportions and never fails to command attention. On several occasions during the past few years, large flights of these moths have invaded the towns of Walla Walla, Washington, and La Grande, and Enterprise, Oregon. The moths came in such numbers that the effect, as they fluttered about lighted store windows and neon signs, was not unlike a heavy snowstorm.

Several summers ago, while participating in the control program against this insect, the writer experienced one of these entomological snowstorms with amusing results. The region around Enterprise, Oregon, where we were working, is essentially "cow country." Stock raising is the principal industry. What logging is carried on deals primarily with ponderosa pine, which is not affected by the budworm. Douglas fir and other affected species of timber, while plentiful, are secondary in importance. Consequently some of the local citizenry viewed our activities with considerable skepticism. It was obvious that we were tolerated as a group of harmless "long hairs" who would soon drift to other pastures. But late one evening this attitude changed. The air of the town was suddenly filled with countless tiny moths, which fluttered through the open doors of lighted bars. Many flapped soggily into unprotected glasses of beer. Cowboys in from a long, hot, dusty day on the range, eager to quench their thirst and talk shop with their pals, were frustrated by this modern version of Pandora's box. They could neither talk nor drink in peace. The situation became critical when several poker games were broken up under the impact of the aerial invasion. From then on, interest in the insect developed rapidly. Large segments of the population suddenly became budworm conscious, and we were quickly elevated to the position of authorities on a major question.

Later that same evening we decided to take advantage of the opportunity to collect specimens. The stores, although closed for the day, had lights burning in the rear, and great numbers of moths were fluttering back and forth along the plate-glass windows. As we worked back and forth along one of these store fronts with our "bug bottles," reaping an easy harvest of moths, I was suddenly startled by a stern, commanding voice. A strong hand grasped my shoulder and spun me sharply around. There stood the local police officer, in anything but a friendly mood. Although I was unaware of it, John Law evidently had missed the discussions in the local grog shops. He obviously figured he had surprised a couple of suspicious characters "casing the joint."

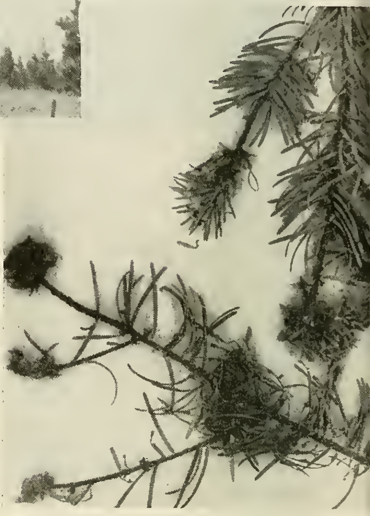
"What do you think you guys are up to?" he demanded. Facetiously we replied that we were "chasing butterflies"—and the expression on his face plainly indicated that now he had heard everything. It required a fancy bit of fast talking to convince him that we were serious workingmen doing one part of a technical job, and not candidates for either the hoosegow or the bughouse.

But the moth is not the direct cause of damage to the forest. The role of bogyman is assumed by the caterpillar—or larva—which feeds upon the newly developing needles as they open in the spring. From a distance, trees that have been heavily infested have a reddish-brown cast somewhat like that of a forest that has been swept by fire. The foliage has been killed or devoured. Upon close inspection, the needles at the tips of the branches look as though they have been singed by a blowtorch. If the infestation is allowed to progress for several years, continued heavy defoliation will eventually kill the timber.



◄ **Helicopters** have been useful in pin-pointing spray in small isolated pockets that conventional aircraft cannot reach properly. Note the nozzled "outriggers"

▼ **Twigs of Douglas fir** damaged by the larvae of the Spruce Budworm



Photos by C. F. Brockman

As with all moths and butterflies, the life history of the spruce budworm embraces four distinct stages. Adult moths are in flight about mid-July, at which time they mate and lay eggs on the underside of the fir needles. In about ten days these eggs hatch, and minute caterpillars, so small that they are barely visible to the naked eye, crawl to crevices in the bark and similar places of concealment, where they hibernate until spring. At about the time the foliage buds are ready to develop, these tiny caterpillars emerge. First boring into the unopened buds, they eventually feed upon the developing needles, growing rapidly by means of a series of molts until they are about an inch long. Literally thousands of these larvae may infest a tree of normal size during a period of heavy attack. Trees of all ages and sizes are often completely overwhelmed within the relatively short feeding period of from two to four weeks. The insect then goes into the resting or pupal stage and within two weeks emerges as an adult moth—thus completing its life cycle in one year—to start the process all over again. One can readily see that, unless controlled or unless natural conditions arrest its spread, the build-up in population within a few years is tremendous. In that manner, the infestation may rapidly spread to uninfected areas.

Only during a relatively short period in the caterpillar stage, when the budworm larvae are exposed upon the foliage, is this insect susceptible to direct attack by insecticide. At that time, specially equipped planes skim over the forest about 100 feet above the treetops, releasing the DDT-fuel-oil mixture from a series of nozzles attached to the underside of the wings. This part of the operation is not one for late sleepers, for the work begins at dawn, when wind and temperature are apt to favor the success of the operation. Sifting slowly earthward, the yellowish-green spray permeates the forest as a mist of countless tiny droplets. The reaction of the budworm larvae to this treatment is immediately apparent. Many are killed by contact with the DDT. Others quickly spin silken threads and begin lowering themselves toward the ground, where they later succumb. In some cases these silken threads become so numerous that the trees appear to have been decorated with tinsel, like evergreens at Christmas. But the men who must investigate the effectiveness of the operation cannot be expected to appreciate this beauty, for they are constantly pawing their way through a maze of annoying cobwebs in the course of their work.

Time is such a vital factor in the control of the budworm that the work goes on during every available minute when the caterpillars can be effectively reached with insecticide. Sundays and holidays are no exception. In the summer of 1950, the crowds of Fourth of July campers who had journeyed to Wallowa Lake near Joseph, Oregon, had to guard their food from unexpected and unwelcome additions of protein. Planes sprayed the area that morning, and the caterpillars literally dropped in on the campers by the thousands. It is doubtful if the addition of budworm larvae would have improved a carefully prepared potato salad. Fortunately these people took the unforeseen and unavoidable situation in good humor. They knew that the DDT, in the formula used, was harmful only to the insects; and the interest generated by the antics of the low-flying planes offset the discomfiture of keeping food safely covered, or of cooking under the protection of an umbrella or a hastily spread tarpaulin.

It was interesting to watch the activity at any one of the several airstrips where the planes were fueled and loaded with insecticide. There, urgency and speed were tempered with carefully planned organization. Every minute counted. In addition, these airstrips often had to be improvised. Only rarely were existing small town airports suitably situated. In some instances, a portion of a level wheat field, rented from a rancher, was used. In other cases, a rocky plateau was leveled by a bulldozer.

The planes themselves were a far cry from the sleek jobs we are accustomed to seeing. These spray planes are "work horses." For the most part they are the old Stearman biplanes, which every pilot remembers as the basic trainer in which he first lifted himself off the ground. Experience has shown that they are the most dependable piece of flying equipment—a most important factor in this dangerous business—and that they can be most easily adapted to the nature of the job at hand. In fact, the entire setup at one of these improvised airstrips, with its dusty work-worn equipment and ordered haste, is reminiscent of an airfield in World War I. Planes roar in, jockey for position at the loading site, fill up with fuel and insecticide, and roar down the runway for another take-off. The entire process requires but a few minutes.

On each area sprayed from the air, ground checks are made to determine whether all parts were covered with insecticide and if not, to provide for reflight over them. The test is made by placing a series of 4 by 4-inch glass plates on the ground at regular intervals along a compass line. If the planes have laid down an effective application of insecticide, each of these glass plates will be spotted with a proper number of spray droplets when they are re-examined after the planes have passed over.

The effectiveness of the spray in destroying the budworm caterpillars is checked in a similar manner. Several days before spraying, ten or more trees are selected at regular intervals along another compass line bisecting each segment of the area. These are tagged so that they can be readily located later. Several branches, each about sixteen inches long, are clipped from various parts of every sample tree. Examination will disclose the number of caterpillars on these samples, and their number is recorded for future reference. In a similar manner, a final check is made some ten to fourteen days after spraying, for in that time the insecticide has completed its work. The difference between the number of caterpillars found before and after is the index of mortality—an indication of the effectiveness of the treatment.

Conservationists have been disturbed by the danger of large-scale insecticide spraying on other forms of life—on small mammals, birds, and insects in general, on pollinating and other beneficial insects in particular, and (very strongly) on fish. Where too heavy a DDT application has been used, the damage to wildlife has been serious, totally upsetting the balance of nature. Proper doses, properly applied, however, will control the forest pests without doing serious damage. Considerable research on this phase has been done by various government agencies.

Although the actual field work—the spraying and checking of results—is the most dramatic part of the budworm control program, it represents but a small part of the effort that goes into the project. In the first place, since time is such a vital factor, success depends upon careful organization. All preparations must be completed well in advance of the actual spraying. Private owners of timberland within the infested areas must be contacted and their co-operation secured. Field surveys are made to determine the extent of the infestation, and these findings are plotted on maps that will be used in briefing the pilots. The status of the budworm's development must be carefully studied by biologists throughout the winter and spring, for upon this depends the setting of the earliest possible date for effective spraying. Contracts must be let for insecticide. Flight operators must be secured. These are but a few of the countless problems that must be considered and solved before the first plane can take to the air.

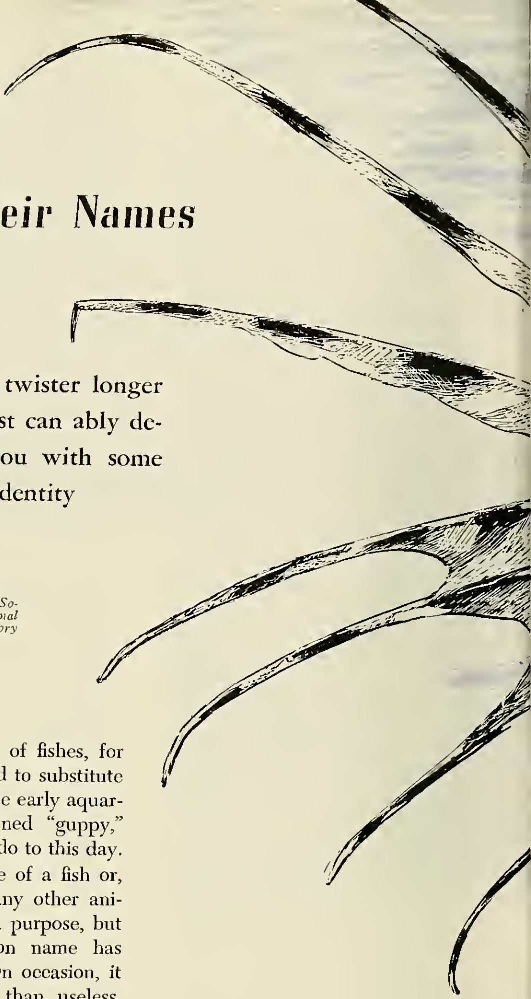
Probably the most effective single feature of this entire program is the *esprit de corps* that exists between the various co-operating agencies. Quite often, intricately co-ordinated projects of this sort figuratively fall apart at the seams at critical times owing to shortsighted personal loyalties. The spruce budworm project in the Pacific Northwest is an outstanding exception. Representatives of the U. S. Forest Service, the Oregon State Board of Forestry, private industry, and the U. S. Bureau of Entomology and Plant Quarantine—all of whom have a vital part in the program—submerge their own identities toward a smooth-working organization. Their fine success in the Battle of the Budworm during the past three years demonstrates what can be accomplished when united effort is brought to bear upon a common problem.

NEW CROP DUSTS WORRY WILDLIFE MANAGERS

DDT, an insecticide that created gray hairs on the heads of wildlife biologists a few years ago when it was first sprayed haphazardly across the nation in heavy concentrations, looks like a mild stimulant when compared to some of the more recent products of the chemists' test tubes, according to the Wildlife Management Institute.

A new crop dust called aldrin is so toxic that 3/100,000 of an ounce of the pure poison will kill a quail. Laboratory tests by James H. Dahlen of the Alabama Cooperative Wildlife Research Unit indicate that this poison is ten times as toxic to quail as toxaphene, and four times as toxic as either dierldrin or Lindane (BHC)—two new sprays that are also gaining in popularity. Fortunately, only 1/1000 of an ounce of 2.5 per cent dust is needed to kill all crop pests. The danger to wildlife lies, as in the case of DDT and the other insecticides, in its promiscuous use by individuals who mistakenly imagine that if a little is good, a lot will be better.

HOW Animals get their Names



The scientific name may be a tongue twister longer than the animal itself. But the scientist can ably defend its use, even as he entertains you with some humorous stories of mistaken identity

By Myron Gordon

Geneticist, Aquarium, New York Zoological Society; Research Associate, Department of Animal Behavior, American Museum of Natural History

When a visitor comes to see the fishes in my laboratory aquarium, the first thing he usually says is, "What kind of fishes are they?"

"That small rainbow-colored one," I may reply, using the approved scientific names, "is *Lebistes reticulatus,* originally from Trinidad and northern South America. This red one with the black spots is *Platypoecilus maculatus,* from the Belize River in British Honduras. That one with the long, green swordlike tail is *Xiphophorus hellerii,* from the streams flowing down the snow-capped peak of Mount Orizaba in Mexico."

The geographical place names may be quite familiar to the visitor, but the scientific names of the fish usually stump him. If I substitute the vernacular names of the fishes and say "guppies, platyfish, and swordtails," my guest smiles knowingly.

Visitors often ask me why scientists use the cumbersome and less familiar name of *Lebistes reticulatus* when "guppy" will do. I could readily say that "guppy," spelled *guppyi,* is a scientific name, though a long-discarded one. The professional students of fishes, for technical reasons, had to substitute another name. But the early aquarists, once they learned "guppy," kept on using it and do to this day.

The common name of a fish or, for that matter, of any other animal or plant serves a purpose, but oftentimes a common name has limited usefulness. On occasion, it is downright worse than useless. Suppose you are interested in studying the natural history of wild rodents in general and the pocket gopher in particular. You are traveling through Florida on a collecting trip. In the backwoods country you stop in a likely locality for these beasts and ask a native if he knows where you can get some gophers.

"Why, we got one in our back yard. We caught it and were going to eat it, but it has become Johnnie's pet now. Want to see it?"

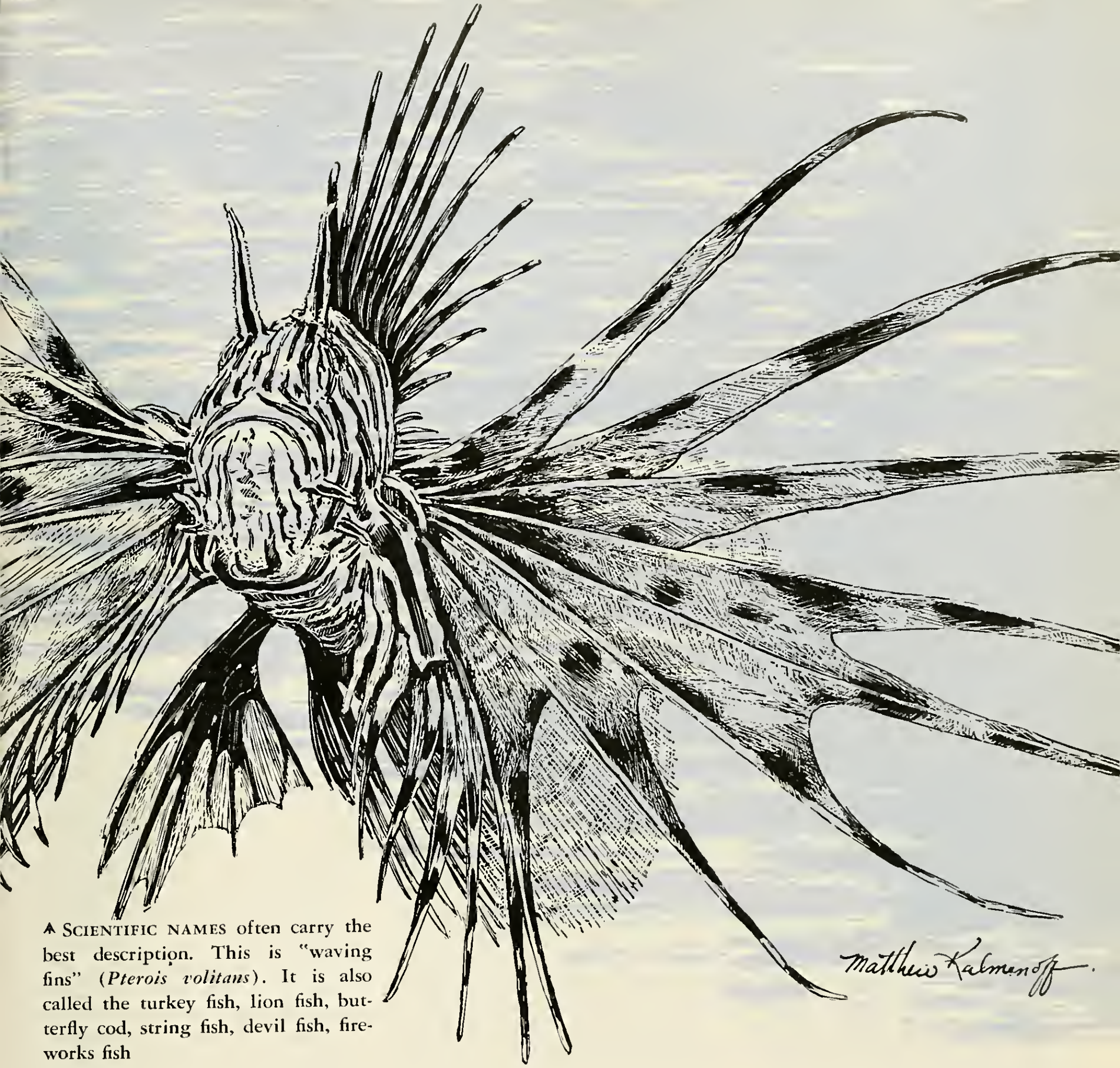
You walk behind the house, peer over the side of an orange crate, and there you see a fine big tortoise! You say, "Why, that's not a gopher, that's a tortoise." But your Southerner insists it is a gopher, and you have that awkward feeling of an outlander.

Then you get an idea. You go back to your car, dig down in your duffel, and pull out a handbook on mammals. You point to a picture of a pocket gopher, and you ask the Southerner, "What do you call this?"

"Why," he says, "anybody knows that's a salamander."

What kind of an animal would you say the swift is? The ornithologist says it's a bird, the herpetologist says it's a lizard, the mammalogist says it's a fox, and the entomologist says it is a kind of moth.

The birds are our best-known animals, for they are relatively



▲ **Scientific names** often carry the best description. This is "waving fins" (*Pterois volitans*). It is also called the turkey fish, lion fish, butterfly cod, string fish, devil fish, fireworks fish

large, colorful, and active. Every kind of bird in America from the Rio Grande north to the Arctic Ocean has already been discovered, described, and named by ornithologists. How many does the man in the street, or on the farm, know? Probably not more than a hundred. Of those he knows and can name, how accurate would he be if he were asked to place them in their natural and related groups? I thought I knew a robin when I saw one, but when I saw a real European robin cavorting in front of me in Kew Gardens in London, a friend had to tell me what the tiny bird was. Our American robin is not a robin but a thrush. In New York and in New England, the partridge is the ruffed grouse. The partridge in the southern states is the bobwhite; and the bobwhite is called the quail in the central states. Our blackbird is a kind of grackle. Our oriole is not a true oriole but a troupial. And the common house sparrow is not a sparrow but a weaverbird. Considering what the layman has done with the common names, you shouldn't blame the scientist too much.

Are scientific names really difficult to learn? Gardeners apparently find many technical words like Iris, Phlox, Magnolia, Chrysanthemum, and Begonia easy, for they use them all the time. Would any smoker be fooled by the name *Nicotiana tabacum* applied to his favorite weed? Any injured person in danger of infection would welcome an injection of penicillin. Actually, the name of this drug is derived from *Penicillium*, a green mold with pencil-like tufts. A related mold, *Penicillium roqueforti*, is responsible for the fine flavor of that blue cheese known as Roquefort.

One hard-bitten lecturer I knew said he could always count on getting a laugh from an aquarium society audience, however bored his listeners were, by ridiculing the scientists about the long tongue-twisting names they give tiny aquarium fishes. "Take our tiny native mosquito fish, the smallest vertebrate in the whole of North America," he would say. "Full-grown males are only about half an inch long, and adult females gravid with embryos are only slightly larger. Do you know what the ichthyologists have done?" he asks derisively. "They named them *Heterandria formosa,* a name longer than the fish." Yet he and all aquarists speak easily and with pleasure of the *Rasbora heteromorpha* in referring to a remarkably beautiful fish from Singapore. *Rasbora heteromorpha* is the only name it has, and it means "different in form from other rasboras"; and rasbora is the native name for the fish. Nobody wants to substitute a common name for this scintillating species with its bright blue fins and golden and red body coloring. Its name, *Rasbora heteromorpha,* has a fine rhythmic sound that is in keeping with the grace, beauty, and rarity of one of the most desired tropical fishes.

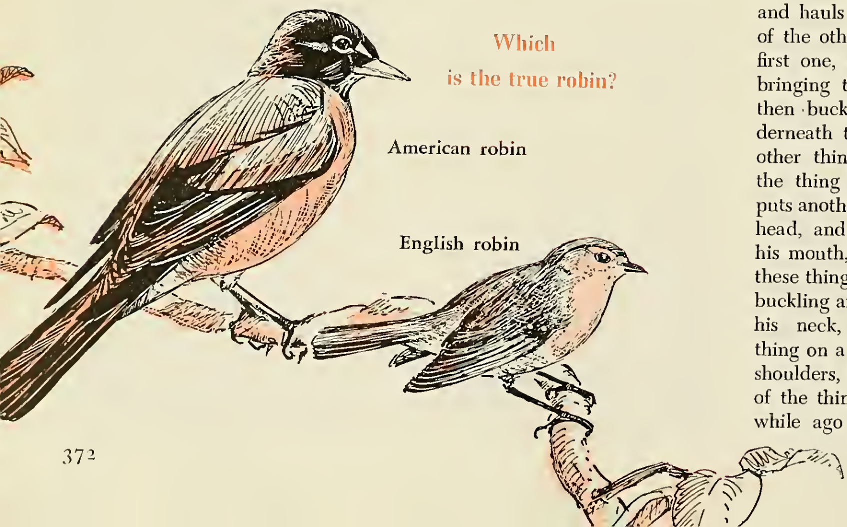
Without the scientific names, how could a Fish and Game director instruct his men? One such official, taking charge of a trout-replenishment program, found the men putting quantities of "pin-minnows" into the trout streams as food for the trout. They were planting four different species of "pin-minnows." One of them, the fallfish, grows to weigh two to three pounds and becomes one of the trout's most serious competitors for food.

Scientific names of animals and plants are part of a detailed system of biological bookkeeping, technically known as classification. In this gigantic arrangement of all the world's organisms, the names of animals alone fill more than sixty volumes, and one or two new volumes appear every year. All the animals, living or extinct, large or microscopic, terrestrial, arboreal, aquatic, or subterranean, are listed in terms of a number of ascending categories: species, genera, tribes, families, orders, classes, and phyla. These categories are intended to indicate the degree of relationship the animals bear to each other and their position in the scale of evolution.

The fundamental basis for classifying animals is the structure of the body. Particularly the skull, teeth, backbone, and locomotor appendages are used. Sometimes the type of skin and its covering are significant (fur, feathers, scales, etc.) or the kind of mouth, kind of breathing apparatus, sometimes even the kind of song. A good taxonomist, the scientist who classifies organisms, must know comparative anatomy, physiology, embryology, and the behavior of the beasts he is studying. His work is much more complicated than that of a technician who works with complicated machinery. A good automobile mechanic can tell by studying several parts of a wrecked, burned-out, and dismembered car not only the make but possibly the year and place of manufacture. Similarly, the zoologist, after years of training, can identify newly-discovered forms by studying parts of their bodies. Sometimes only fragments of bones and teeth are sufficient for him to locate the owner's place in the all-inclusive zoological catalogue. A newly-discovered jawbone from a manlike creature is likely to make the front-page headlines, because from that meager evidence anthropologists may be able to construct a reasonable likeness of the whole body.

Nobody can be an expert in a profession or business without learning the names of the tools or technical terms of his trade, be he an automobile mechanic, a lawyer, a shoe designer, or a plumber's helper. And that goes for farming, too. Words like hames, whippletree, terrets, and many more—meaningless to the city dweller—are common terms to the horse-and-buggy farmer. Mark Twain described in his *A Tramp Abroad* how they hitched horses in Europe:

"The man stands up the horses on each side of the thing that projects from the front of the wagon, throws the gear on top of the horses, and passes the thing that goes forward through a ring, and hauls it aft, and passes the other thing through the other ring and hauls it aft on the other side of the other horse, opposite to the first one, after crossing them and bringing the loose end back, and then buckles the other thing underneath the horse, and takes another thing and wraps it around the thing I spoke of before, and puts another thing over each horse's head, and puts the iron thing in his mouth, and brings the ends of these things aft over his back, after buckling another one around under his neck, and hitching another thing on a thing that goes over his shoulders, and then takes the slack of the thing which I mentioned a while ago and fetches it aft and



Which is the true robin?

makes it fast to the thing that pulls the wagon, and hands the other things up to the driver." Farmers found it easier to say "terrets" than to say "the rings that stick up in the middle of the harness on the horse's back that you pass the reins through."

Biologists took a long time to simplify and improve their rules for naming and classifying the many hundreds of thousands of animals and plants of the world. Scientific names must be internationally understood, because animals and plants, unlike man, know no political boundaries. An inventory of the world's living things must be universal in scope and written in a universal language. In the early days of scientific endeavor, during the eighteenth century, Petrus Artedi found in Naggs Head Inn in London a natural history curio in the form of a hard, dried fish. He described it, saying it was like a bony little box, triangular in shape and with two horns in front and two spines under the tail. Artedi, the father of ichthyology, translated his description of the fish curio into Latin and produced this prayer-like sounding phrase: *"Ostracion triangulatus duobus aculeis in fronte et totiden in imo ventre subcaudalesque binis."* For a while, that Latinized verbal picture was the scientific name of what we know today to be the common horned trunkfish. Later, Carolus Linnaeus, in 1758, streamlined Artedi's cumbersome appellation to the first two words, *"Ostracion triangulatus."* Linnaeus, the great Swedish naturalist, did this for all the animals and plants known to him, and in so doing he initiated the practice of Binomial Nomenclature. His invention was one of the greatest steps forward in the history of biology.

Linnaeus' fundamental book *Systema Naturae* was published in 1758. One hundred years later it simplified Charles Darwin's enormous task of producing the *Origin of Species.* Linnaeus' basic method of classification, incorporated in the modernized International Rules of Nomenclature, is in use today. New interpretations of the rules and new decisions are made by a group of present-day biologists representing many countries of the world. Their rules and regulations are rigidly enforced. The most important and the most inflexible one is that no two organisms, plant or animal, living or fossilized, shall have the same binomial. Or stated in another way, all animals of the same kind must have the same binomial.

How the "Guppy" Got its Name

The "guppy" is a household word. Pictures and stories of this tiny fish appear in newspapers and humorous magazines. It is the most prolific pet man has ever had. The guppy is replacing the guinea pig and the rabbit in the public mind as the epitome of fertility. How did the guppy get its name?

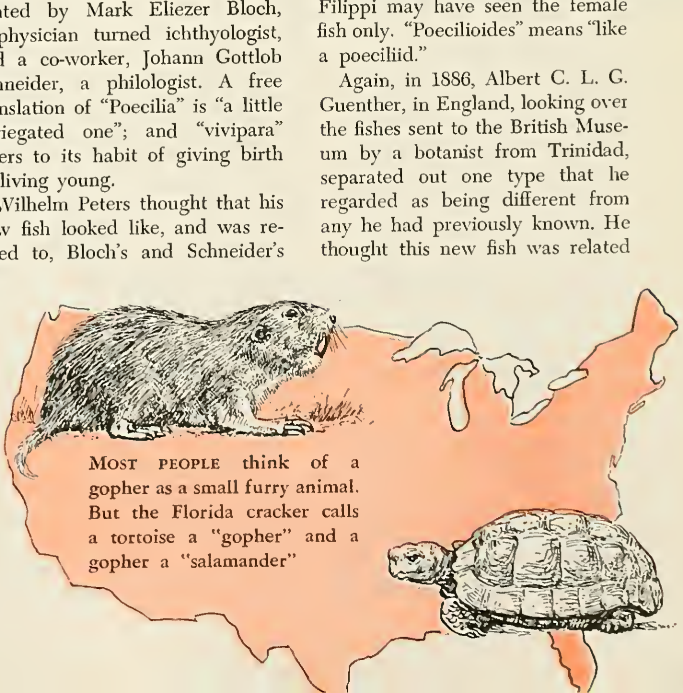
In 1859, Wilhelm Peters, in Germany, obtained and described a small fish from Venezuela which he considered new to science. He was privileged to attach to it a new name, which was *Poecilia reticulata.*

"Poecilia" is a word that had been coined much earlier, in 1801, for a somewhat similar fish called *Poecilia vivipara*. It had been invented by Mark Eliezer Bloch, a physician turned ichthyologist, and a co-worker, Johann Gottlob Schneider, a philologist. A free translation of "Poecilia" is "a little variegated one"; and "vivipara" refers to its habit of giving birth to living young.

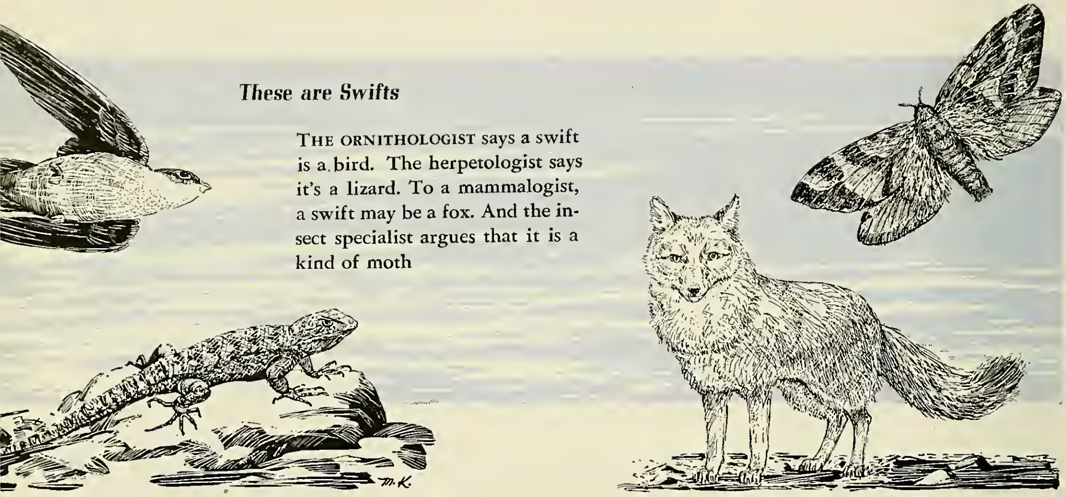
Wilhelm Peters thought that his new fish looked like, and was related to, Bloch's and Schneider's *Poecilia vivipara.* To distinguish his fish from those previously described under the term *Poecilia,* Peters gave it the new specific name of *reticulata* (meaning "reticulated" or "netted"). *Poecilia,* in scientific parlance, is called the *generic* name. It is the name of the genus. *Reticulata* is called the *specific* name, or the name of the species. Together they make up the scientific name or binomial.

Two years after Peters' description of *Poecilia reticulata* was published, F. de Filippi, an ichthyologist in Italy, described another small fish, which had been sent to him from the West Indian Island of Barbados. Whether de Felippi read Peters' account of *Poecilia reticulata* is not known, but apparently de Filippi thought he, too, had another new fish previously unknown to science. He described it carefully and named it *Lebistes poecilioides.* The generic name, *Lebistes,* had not previously been used. It informs us that, in de Filippi's estimation, this fish is not quite like the other *Poecilia* fishes described by Bloch and Schneider. The word "Lebistes" refers to a kettle or pot, probably from the pot-bellied appearance of a gravid female, and this suggests that de Filippi may have seen the female fish only. "Poecilioides" means "like a poeciliid."

Again, in 1886, Albert C. L. G. Guenther, in England, looking over the fishes sent to the British Museum by a botanist from Trinidad, separated out one type that he regarded as being different from any he had previously known. He thought this new fish was related



MOST PEOPLE think of a gopher as a small furry animal. But the Florida cracker calls a tortoise a "gopher" and a gopher a "salamander" to those under the name of *Girardinus,* a kind of Cuban toothed minnow described by Felipe Poey y Aloy in 1855, at Havana. (Poey created the word "Girardinus" in honor of Charles Girard, a famous Swiss-American ichthyologist.) A. C. L. G. Guenther, as a compliment to the collector of the fish, botanist R. J. Lechmere Guppy, named this fish *Girardinus guppyi.* It was under this scientific name that the fish was brought alive, in the early 1900's, to the attention and delight of the German and English aquarists. Guenther, a German-born English keeper of the British Museum, was the authority to whom early fish fanciers turned for guidance in matters of this sort. Guenther paid his friend Guppy a lasting compliment indeed, for "guppy" is heard everywhere—although those who use the name rarely realize its significance and history. And it is a twist of fate that a botanist should be best remembered for a fish.



These are Swifts

THE ORNITHOLOGIST says a swift is a bird. The herpetologist says it's a lizard. To a mammalogist, a swift may be a fox. And the insect specialist argues that it is a kind of moth

Because this little fish we call guppy varies greatly in coloration and fin structure, in addition to being different in the male and female, we need not be surprised that three ichthyologists, working in different countries, all thought they had something different and new. That is how the fish known to aquarists as the guppy had three different scientific names all at the same time.

Regan—Fish Detective

In 1913, C. Tate Regan, then a young ichthyologist and later the Director of the British Museum, made a careful study of the whole group of poeciliid fishes. He discovered that the male's sexually modified anal fin, or gonopodium, was a valuable index in finding relationships between members of this viviparous group of fishes.

Regan came to the conclusion, after reading the previous publications in English, Spanish, German, and Italian, that the three names mentioned above represented mere variants of a single species. Accordingly, he was obliged to follow the rule that only one scientific name must represent it. In selecting one of the three names, Regan was bound by another regulation of the International Rules of Nomenclature. The code indicates that the *first* name applied to a specimen must be preserved, providing that the first name does not already refer to a different animal or group of animals.

The first scientific name was *Poecilia reticulata,* but the other species of *Poecilia* in the British Museum, such as *Poecilia vivipara, Poecilia parae,* etc., did not have the required closeness of relationship to *Poecilia reticulata.* So, he was unable to use *Poecilia.* He then considered the next generic name, *Lebistes,* proposed by de Filippi. Since *Lebistes* was coined especially for this fish and had never been used before for any other organism, Regan found it suitable. He therefore combined de Filippi's generic name *Lebistes* with Peters' specific name *reticulata.* Thus Regan indicated that *Lebistes reticulatus* was the valid scientific name. (The change of *reticulata* to *reticulatus* was made on grounds of gender.) Consequently, by this orderly process, Guenther's binomial, *Girardinus guppyi,* was superfluous and had to be discarded as a scientific name; but as you know, part of it, "*guppy,*" has been retained among fish fanciers ever since.

This may seem an extremely involved procedure to the lay reader. But it is inevitable that the same fish will occasionally be given different technical names, and it is essential to have a system that will provide for only one official name. Otherwise, chaos would result. An aquarist, looking in a tropical fish catalogue, would see the names: 1) *Poecilia reticulata,* 2) *Lebistes poecilioides,* 3) *Girardinus guppyi,* and he would readily conclude that three different species of colorful fishes, from northern South America, Trinidad, and Barbados, were being offered for sale.

Varieties and Species

The zoologist uses the word *variety* to represent different color variations and other minor deviations within animals of a single species. A species may have a large number of *varieties.* For example, *Platypoecilus maculatus* has many varieties, known to the aquarist as the red platy, black platy, blue platy, gold platy, leopard platy, the crescent, moon, twin-spot, one spot or comet, and many more, including the newly developed wagtail platy. Varieties are referred to by common names followed by the scientific name, as for example, gold platy (*Platypoecilus maculatus*). Varieties of species usually occur together in the same local population and freely interbreed. On the other hand, different species of a genus usually come from different geographical localities.

Locating an Aquarium Fish

To illustrate the zoological standing of a common aquarium fish, such as the wagtail platyfish, the following are the various divisions of the animal kingdom to which it belongs:

KINGDOM—ANIMAL, as distinguished from plants
Phylum Chordata—animals possessing a supporting structure called a "notochord"
Sub-phylum—Vertebrata, or chordates with backbones
Class—Osteichthyes, the bony fishes
Order—Cyprinidontiformes, the toothed minnows
Family—Poeciliidae, the viviparous toothed minnows
Genus—*Platypoecilus,* the broad, variegated kind
Species—*maculatus,* the marked or spotted one
Variety—wagtail, black-finned

Each organism is given two names, a generic name (*Lebistes*) and a species name (*reticulatus*). In scientific nomenclature, the more important name (corresponding to a person's family name) is written first, Chinese style, and the one corresponding to the given name comes second. Only the first scientific name, designating the genus, is ordinarily capitalized. Many aquarists write *Lebistes Reticulatus, Rasbora Heteromorpha,* capitalizing both names as they would John Jones and Tom Smith, but this is not conventional. The name of the person who first described the animal, if it is used at all, is placed at the end of the italicized scientific name: *Lebistes reticulatus* (Peters). The parentheses around the author's name indicates that he did not coin the generic part of the name.

Some people cannot abide technical terms—like Broadway's Billy Rose. Billy, in one of his witty "Pitching Horseshoes" stories, tells how his wife Eleanor, an expert driver, instructs him to start the car.

"Just turn this jigger over," she says, "push in this dingus, pull out this doohickey, step on this wingdoodle, press down on this thingamabob, and you're all set to go."

Billy is confused and asks, "What is this gizmo?" And so it goes.

Many biologists, being learned in Latin and Greek as well as in natural history, have created scientific names that are appropriate and delightful. I like the impish name of *Pluto infernalis* for an eel-like fish that lives in the dark underground waters of Yucatán. It is pleasing to learn that the king of the tyrant dinosaurs is called *Tyrannosaurus rex.*

Biologists are human. The sad part is that when they give way to their whims or weaknesses, the names they bestow may be difficult to eradicate. Even as late as 1926, Dybowski introduced the following generic names in describing the water fleas of Lake Baikal: *Nematoceroechinogammarus, Gammaracanthuskotylodermogammarus,* and *Parapallaseakotylodermogammarus.* We can only hope that these will not lose anything in the translation.

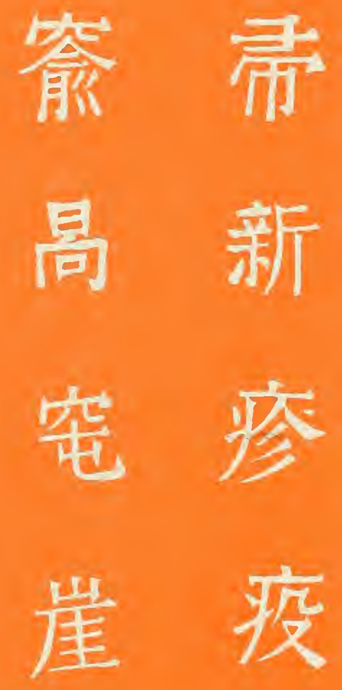
Scientists also occasionally make mistakes, some of which unfortunately will be preserved for all time. For example, the king crow or drongo is a native of the Malayan Archipelago. The taxonomist who first described it thought it came from South Africa; consequently, he named it *Dicrurous hottentottus,* meaning "the forked-tail bird from the land of the Hottentots." An early eighteenth-century zoologist thought that the common water flea was a flea (although it is really a kind of fresh-water shrimp), and he gave it the specific name of the flea, *Daphnia pulex,* which means in its entirety "the nymphlike flea." Aquarists all over the country will recognize the word "Daphnia" as the name of the tiny live organisms they buy to feed their fishes.

Biologists have used scientific names to flatter or honor their patrons or friends. An English botanist of the Victorian period named the world's largest water lily *Victoria regia.* Ornithologists of the nineteenth century graciously named the wondrous birds of paradise for the royalty of their times, so that we now have the King of Saxony bird of paradise, Crown Prince Rudolph's bird of paradise, Lady Macgregor's bird of paradise, and so on. Charles Louis Bonaparte, a French ornithologist and a grand-nephew of the great Napoleon, rebelled at this form of flattery. When he had the opportunity of naming a new bird of paradise he wrote, "I have adorned the most exquisite bird of paradise with the name of a Republic, *Paradisaea republica.* Even though a paradisean republic does not exist, at least there is now a *Paradisaea republica.*"

What are scientific names? A bit of natural history, a bit of the classical languages, and a bit of human (*Homo sapiens*) endeavor.

Movable metal type was in us

THE KOREANS *were ahea*



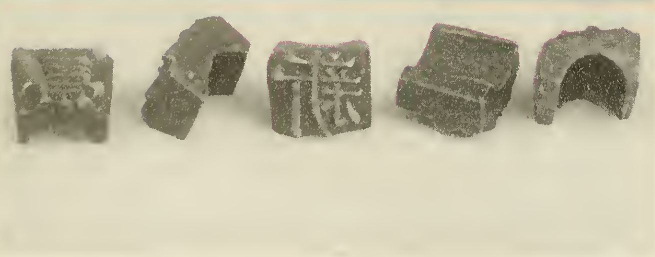
MILLIONS of words about Korea have appeared in print in the past twelve months, but little has been said of the Hermit Kingdom's part in the developments that made printing possible.

The story is an old one, and much of it has actually been lost. Enough is a matter of record, however, to show that Korean printers used movable type long before Johannes Gutenberg invented it in Germany. In fact, even what is supposed to be the oldest *cast metal* type now in existence was made in Korea in 1403, at least 37 years before Gutenberg's invention, and is now to be seen among the collections of the American Museum of Natural History.

The type in the American Museum was obtained in Korea in 1897 by Homer B. Hulbert, the author of *The History of Korea.* He was given the type by the Education Department in Seoul, where he found remnants of all three of the first sets of cast metal type, from 1403, 1420, and 1434. Of the oldest set, there were only 53 pieces left, and Mr. Hulbert states that those were the ones that the Minister of Education gave him. Testimony later given by the curators of the Seoul Museum, however, casts some doubt on this.

The circumstances under which the world's first metal type was cast show Korea to have been an enlightened and progressive country almost a century before Columbus came to America. The story of the invention of metal type is told in Korean in a book printed only six years after the first type was cast, as follows:[1]

"In the second moon of the first



AMNH Photo

▲ EARLY CAST METAL TYPE from Korea on exhibit in the American Museum of Natural History. Above, actual printing from the type shown

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[1] From *The Invention of Printing in China,* by Thomas Francis Carter, Page 171.

:ea long before Johannes Gutenberg invented it in Germany

f Gutenberg

By Hawthorne Daniel

year of *Yung-lo* (1403), the king said to his attendants, 'Whoever is desirous of governing must have a wide acquaintance with the laws and the Classics. Then he will be able to act righteously without and to maintain an upright character within, and thus to bring peace and order to the land. . . . The books printed from blocks are often imperfect, and moreover it is difficult to print in their entirety all the books that exist. I ordain therefore that characters be formed of bronze and that everything without exception upon which I can lay my hands be printed, in order to pass on the tradition of what these works contain. That will be a blessing to us to all eternity. However, the costs shall not be taken from the people in taxes. I and my family, and those ministers who so wish will privately bear the expense.'

"Then was money in great abundance given from the private treasury of the king, and officials appointed [list of names] to superintend the undertaking and to carry it out. The Book of Poetry, The Book of History and the Commentary of Tso were given from the royal palace to furnish models for the type. The casting began on the nineteenth day of the same month, and within a few months several hundred thousand type had been cast. . . . These type were cast in order that all books might be printed. May they extend to a myriad volumes in number and be handed down through a myriad of generations. Thus vast was the design, so deep and far-reaching the thought that inspired it."

The attitude of the Koreans toward their discovery of cast metal type was voiced further toward the end of the century: "Fortunately through the inventive wisdom of the sages of our dynasty, who have discovered the art of casting type to print books, all Classics, histories, books of philosophy and literary collections are in every home." Thomas Francis Carter, who has made a special study of printing in the orient, points out that the enthusiasm went so far that, when there was a lack of bronze, the bells of ruined monasteries and vases and instruments belonging to individuals and to the various government departments were melted up.

The casting of metal type was not the first step, of course, in the evolution of printing. Korea and China have always been in close contact, and the earliest steps in this Far Eastern field of printing took place in China.

Anyone who has ever dealt with a Chinese laundryman and has claimed his laundry by matching a torn piece of paper with the portion retained by the laundryman, must have recognized the simple effectiveness of this method of identification. But modern Chinese laundrymen were not the ones who thought that up. Long before the Christian Era began, the Chinese were using the idea. If a contract was to be made, for instance, its terms were sometimes written on each end of a piece of bamboo which was then broken in two, one piece being retained by each party. And sometimes, in order even more definitely to identify these "documents," bits of moistened clay or wax were pressed on them and stamped with the impressions of carved seals that were usually made of stone.

By the sixth century of our era such stamped impressions were often being made on paper instead of on clay or wax. A kind of red ink apparently made from cinnabar was commonly used. For this purpose carved *wooden* seals were found to serve best, and here were the first true printing blocks. It was from this beginning that block printing evolved, and whole pages ultimately came to be printed from single blocks. Thus an accurate method of duplicating handwritten copy was developed.

A piece of wood—usually pear wood or plum—was cut to about the size of a present-day sheet of foolscap. It was kept to a thickness of an inch or less, and was carefully smoothed and then soaked in water.

THE ORIGIN OF PRINTING

Date	
712-756	Probable origin of printing by wood block (China)
770	Earliest well-defined block prints (Japan)
868	Earliest book printed by block printing (China)
935-954	First paper money printed (China)
1032	Paper money printed in excess. Inflation
1068	First counterfeit bills
1041	Movable type of clay (Pi Sheng of China)
1147	Woodcuts for capital letters (Benedictine Monastery at Engelberg, Switzerland)
1403	***First cast metal type (Korea). An order for the establishment of a royal type foundry had been given eleven years earlier***
1409	Possibly the earliest book printed from cast metal type (Korea)
1420 & 1434	Additional fonts cast in Korea
1448	Earliest specimen of a European book printed from movable type, probably an independent invention
1450-55	First Gutenberg Bibles—earliest complete European books printed from movable metal type
1488-1506	Earliest printing from cast metal type in China

Next, the written page that was to be duplicated was pasted *face down* on the wooden block. When the page was dry, the paper was carefully rubbed away with moistened fingers in exactly the same way that we sometimes remove the paper from a stubborn pattern of decalcomania, leaving the inked characters still visible on the wooden block. Next, the wood about the characters was cut away with a chisel to a depth of an eighth of an inch or so, leaving the printing surface raised.

Excellent printing was attained by this method, but it had not long been in use when, about the year 1041, a certain Pi Sheng cut separate characters in wet clay and baked them hard. When he wished to print, he glued them in their proper order to a flat surface, inked this "type," and pressed his paper down upon it.

The foundation to which these clay printing blocks were glued naturally had to be rigid and strong, with the result that these "base plates"—they were actually shallow rectangular trays—were often made of iron. The clay type, however, readily broke down in use and other materials were consequently tried. In the course of time, type of this design was made not only of clay, but also of wood, iron, tin, lead, and copper.

No one of these materials, however, proved to be entirely satisfactory. Consequently alloys were evolved. These undoubtedly varied widely, but an analysis that was made of some of the Korean cast metal type in the collection of the Franklin Institute in Philadelphia—type cast in the year 1434—shows that a small amount of iron was alloyed with similarly limited proportions of lead and zinc, and with much larger proportions of copper and tin. In fact, the analysis even shows the presence of a very small percentage of manganese.

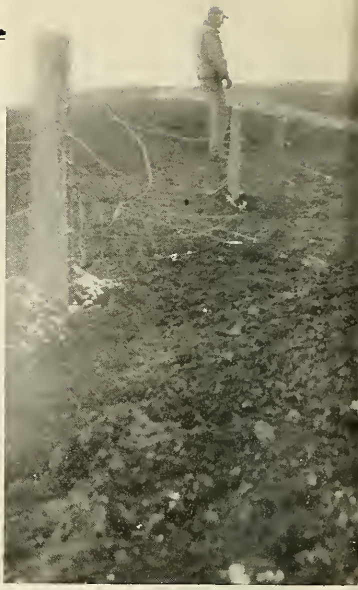
Cast type of this period was rectangular in shape and often had a wide, deep groove across the underside. As the type was set, this deeply indented base was pressed into a thick layer of adhesive, which held it firmly. The adhesive was generally a mixture containing resin and wax, and the shallow tray or "base plate" that supported the type was still commonly made of iron. Once the type was set, the printing surface was "leveled" as accurately as possible with a smooth block of wood.

There was no printing press. The printer merely sat cross-legged before his tray and used a brush to apply liquid ink to the printing surface. He then laid a sheet of paper lightly on the form, brushed or patted it with a felt pad, and carefully lifted it off. Nor was this method so slow as one might imagine. It is said that an experienced workman could strike off 1500 impressions a day.

The Chinese never developed an alphabet, but during the fifteenth century the Koreans invented one containing eleven vowels and fourteen consonants. Thus the task of printing came to be simpler in Korea than in China. Korean printing, however, was well established on a basis of Chinese characters long before the Korean alphabet appeared.

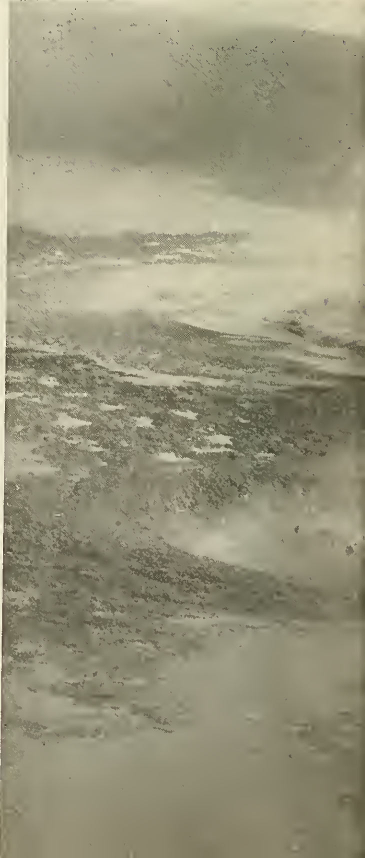
Movable type — even movable *metal* type—was in use in Korea long before *cast* metal type was evolved. The exact date at which the first movable type appeared, however, is unknown. A Korean official named Li-Ku-Po, however, who died in 1241, left a record saying that his father compiled a book that was printed from movable metallic type sometime between 1224 and 1241.

The Koreans of today are naturally proud of these achievements, just as they are proud of the fact that they built the first warship that used metal plates and a metal ram, erected the first successful suspension bridge, built the first bombs and the first mortar, and, alone among the people of their part of Asia, evolved a phonetic alphabet. And it is unfortunately probable that at the present moment many valuable old records of these and other Korean achievements are being damaged or destroyed in the struggle that now is battering so many of the cities of the long suffering Hermit Kingdom.



▲ "THE MORNING AFTER." Fences had been buried, and the whole face of the land had been altered

Malcom Epley, Jr., photos



MUD *Gusher*

Overnight a "thousand-foot" geyser buried a farm under mud, and two Californians agree that Surprise Valley is a good name for the place where they settled

By EDITH RUTENIC MCLEOD

LIKE the farmer's cornfield in Mexico where the volcano Parícutin now stands, 20 acres of meadowland belonging to two farmers in Surprise Valley in northeastern California, are now covered with mud 12 feet deep in places. Early explorers had called it Surprise Valley because of their astonishment, after weeks of weary travel through arid plains and mountains, to see a long fertile valley dotted with lakes and teeming with wildlife. Now it has another reason for being called Surprise.

On the first of last March, with startling, wholly unexpected violence, a geyser-like eruption broke through the earth's crust with the roar of a tornado. Witnesses said it shot hot water and mud 1000 feet into the air. One witness asserted that the column of mud and water shot as high as one could see in the black, starlit night. The Giant Geyser in Yellowstone National Park lifts its main column of hot water to a height of 50 to 60 feet and sends a thinner column of water 250 feet into the air. So unless the estimates of the Surprise Valley eruption are gross overstatements, it represents a phenomenon that is as unique as it is amazing.

Unlike Parícutin, further growth or violence is not anticipated. But Paul Robinson, Modoc County Supervisor and rancher, and Joe Parman, rancher, are looking ruefully over their once-fertile meadowland and wondering to what account they can turn 20 acres of boiling and caking, infertile mud.

Two weeks before the eruption, Robinson recalls, there was a slight earth tremor in the area. No local earthquakes of any considerable magnitude have ever been felt by residents of Surprise Valley, even within the memory of the oldest inhabitants, though numerous hot springs have long been known to exist in the region.

For about three hours before the eruption there was a continuous rumbling in the earth, which caused considerable anxiety among those living in the vicinity. The Robinson home shook mildly. Mrs. Robinson says that she might have thought a tornado was approaching, except that tornadoes are unknown in this mountainous country.

At 10:30 P.M., the valley lived up to its name in a splendid, surprising, though terrifying manner. The Robinsons say that a violent rumble and explosion accompanied the eruption. They rushed outside and saw against the starlit sky a huge column, "black against the night like the funnel of a tornado," shooting mud and water 1000 feet or more into the air.

The scientifically-minded might

◄A NIGHTMARE CAME TO LIFE: boiling mud pots left in the crater after the eruption

have enjoyed this rare display of Nature in a violent mood, but unfortunately the spectacle took place after dark and without warning, except for the puzzling rumblings preceding the outburst. There was little sleep that night, and at 4:30 A.M., the new spring was still erupting hot water and mud high into the air. It had spattered mud as far away as four miles. Mud-spattered horses huddled in the far corner of the field, but within a short time birds were flying about, seemingly oblivious of the spouting hot spring, the steaming mud, and the changed aspect of the region.

At 10:00 A.M. on March 2, a second eruption occurred, accompanied by loud roaring. It is estimated that this second outburst sent mud and water 200 feet into the air. The spouting gradually decreased to 100 feet, and then to 75 as the day wore on.

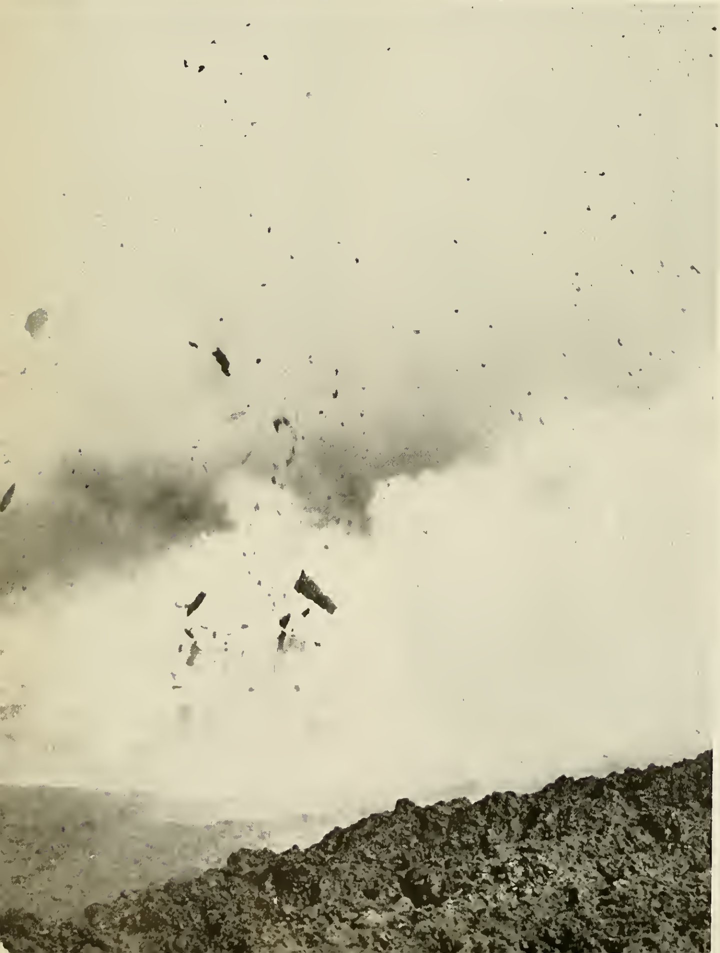
By the following day the intermittent spouting had decreased to around twelve feet of mud and steam. The height might have been greater but for a strong wind that was blowing. The irregular craters of the hot spring, scattered over an area of about ten acres, were filled with boiling mud, and innumerable other mud pots were starting to boil. A pungent odor emanated, though it was not especially sulphuric. Surrounding these ten acres, were another ten acres of mud that thinned out toward the edges. In places, near the spring, the mud was twelve feet deep, with steam issuing from many points.

Mrs. Joe Parman says that a pole gate on the site of the eruption completely disappeared. A pole gate is a large, heavy gate, wide and high enough for a loaded hay wagon to go through. Two heavy posts about 12 feet in height support this type of gate, with a beam across the top. It is conjectured that the gate collapsed and was buried by the mud.

About two weeks after the initial outburst, most of the mud pots had dried up. At this stage a third, smaller eruption occurred, shooting up some mud but mostly steam, to a height of around 35 feet. This small outburst threw mud around the edges of the crater but was not spectacular. The region seems now to have settled down to a relatively quiet permanence of boiling hot springs, one of which is especially active.

The geyser-like eruption and the accompanying mud pots and hot springs occurred in a region containing about 100 hot springs, scattered over an area of 100 acres. The springs range in diameter from 6 inches to 20 feet and have been there since white men moved into the valley 100 years ago. Residents

James Southers photo



◀ CHUNKS of mud were still being thrown up the second day. The big eruption took place at night

James Southers photo

▲ **The activity** subsided gradually. A repeat performance is not impossible, geologists believe, in a region recently subjected to crustal movements

Malcom Epley, Jr., photo

▲ **Photographer** standing near the edge of the boiling mud cauldon. The low steaming hill in the background is the heaped-up mud blown out by the first eruption. In the foreground is one of the larger hot springs that dot the meadow

assert that individual springs have been known to erupt hot water (but no mud) up to a height of 100 feet, leaving the basin empty for quite a long time.

Surprise Valley is in Modoc County, just east of the Warner Range, a range of recently faulted block mountains. A fault, in geologic parlance, is a fracture in the earth's crust, with resulting displacement. There are many of these fractures in the Warner Range. A long one lies at the eastern base of the range, and it is near this fault line that the hot springs occur. I. C. Russell, in *U. S. Geological Survey, Fourth Annual Report*, 1884, describes it as "a line of profound displacement, which has resulted in the upheaval of one of the grandest of the Basin Ranges. This line of displacement is marked by numerous hot springs and by fresh fault scarps, from 20 to 50 feet high, that cross alluvial cones and cut embankments and terraces of Quaternary age, telling in the plainest language that the rocks bordering the line of fracture have been disturbed at a very recent date, and that the Warner mountains are young, and probably growing."

Forty-four years later, in 1928, Richard Joel Russell, after making a detailed study of the range, verified all of the above statements in his published findings, *Basin Range Structure and Stratigraphy of the Warner Range*.

Hot (and cold) springs are common where faulting has occurred, for through the breaks in the earth's crust the waters below can find escape. Geologists and volcanologists agree that dynamic phenomena can be expected from time to time, on a small scale and even, perhaps, on a larger scale, not only in this particular region but all up and down the western mountain system. Volcanic activity, faulting, and mountain building have by no means ceased.

▼ **One** of the smaller mud pots. The dog's curiosity resulted in a burned foot

James Southers photo

Continued from page 338

no authenticated case of rattlesnake bite where no symptoms of any sort, such as pain and local swelling, were reported. Cyanide is certainly not recommended as an antidote to snake bite. The possibility cannot be ruled out that the snake was not in good health and would have succumbed regardless of the events as reported above. It is not uncommon for the professional collector to encounter the parasite-infested, disease-ridden animal.

Squirrel in Sock

SIRS:

The half-grown gray squirrel in these photographs was found in an old barn by Rudolf Freund, the illustrator. It is Rudi's belief that he was the runt of a litter and was abandoned by his parents. At the time of discovery, he was about six weeks old, tiny, and very weak. His eyes were open, and he had a light covering of fur. Alfonse, or "Al," as he was called, was fed warm milk, containing Viosterol, with an old medicine dropper, then wrapped in a wool sock, and placed in a box beneath a lighted bulb to keep him warm.

For several days he had to be fed every three hours around the clock. When he was able to recognize the approaching dropper, he would squeal until the milk stopped the noise! Al thrived on the mixture and grew in strength daily. As his teeth developed, shelled nuts, raw carrots, and almost any kind of green vegetable were added to his diet.

Now he gets whole nuts plus fortified milk and vegetables. That his teeth are sharp we know from experience. He is loyal only to his friend and feeder and makes fierce "chirrrs" at anyone else. He ranks in size with the largest grays, and his coat and tail are magnificent.

The photographs show his method of returning to his bed while young. After eating until his abdomen resembled a golf ball, Al would jump from a hand to the wool sock, go down to the toe, turn around, and pop his head out of the top.

Contrary to the opinion of some authorities, we have found that it is possible to raise gray squirrels from tiny babies to maturity and have had excellent results with four grays found when they were about three or four days old. Raising gray squirrels requires patience and slow gentleness, but the results are very rewarding.

HIRAM L. PARENT
Madison, Conn.

* * *

SIRS:

As a new reader of NATURAL HISTORY, may I offer you my compliments on an attractive, readable publication . . .

H. S. SCHEIN
Louisville, Kentucky.

▲ AL, possibly the abandoned runt of a litter, was raised to sturdy adulthood on milk and Viosterol

▲ HE WOULD jump into the sock, go down to the toe . . .

➤ . . . and turn around to pop his head out

THE MYSTERIOUS LAND OF THE BAGOBOS

Continued from page 351

dayandi, or blood compact. Two traditional enemies, such as a Bagobo and a Moro, decide to become friends. Each cuts his wrist until the blood flows freely. Then each drinks the other's blood, signifying that they are henceforth blood brothers.

We came out of the jungle at last into the frontier town of Malagos. Here Ranon insisted that we remain at least one night as guests in his house.

Ranon's house, although it consisted of only one room, was so large that it seemed like an auditorium or a theater. The sleeping platform across one end of the room resembled a stage. Alcoves down one side of the room were like theater boxes. The walls were covered with booty captured on Ranon's many raids into enemy territory. There were many masterpieces of native workmanship — spears, shields, drums, copper gongs, jars and plates, beaded clothing, baskets. Also there were a few things from the outside world. A favored position was given to an advertisement of an American brewery.

It was late and, after eating, we were shown to their quarters — the stage. We had the sleeping platform to ourselves, while Ranon and his wives occupied one of the alcoves, and no more nor less than 22 of the magani's immense family slept on the open floor. Surely there was never a more public bedroom. But publicity did not inhibit Ranon and his three spouses, judging by the sounds that strayed from the alcove. After all, he had been gone a long time.

Lieutenant Alivolo came in the morning. He was stationed in Malagos as an officer of the Constabulary. He helped me to pose photographs of Ranon and his family, and he interpreted while I plied Ranon with questions concerning his domestic affairs.

It developed that Ranon had had seven wives, but four had died. Whether he had been instrumental in the demise of any of these four, we did not learn. The Lieutenant explained that, under Bagobo custom, it was perfectly ethical for a husband to kill an unfaithful wife and her admirer as well, and count these two deaths to his credit as a magani.

Besides his wives, Ranon had fourteen slaves, taken prisoner on his various raids. The Lieutenant explained that slavery is a loose institution among the Bagobos. The children of slaves are free, and even the slaves themselves frequently marry members of the ruling tribe.

I asked what there was to stop an aspiring young chief from donning red even though he had not killed the required quota.

Ranon looked shocked. "The spirits would make his body swell and turn yellow," he said, "and he would die."

"What is the largest number ever killed by a magani?"

"Three hundred," said Ranon. "It was when I was a boy. The Bagobos and Atas were deadly rivals. They tried to outdo each other in killings. One Bagobo warrior and one Ata excelled all the rest. One would be ahead for a little while, and then the other. The race lasted for five years. Finally, when each man had a record of three hundred deaths, they agreed to stop. They performed the ceremony of *dayandi* and became blood brothers."

▲ AL's milkbottle was an old medicine dropper

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BOOKS

Continued from page 343

The work comprises ten chapters, appendices concerning specifically identified and banded birds, a bibliography, and an analytical index. The photographic illustrations are not only of the highest standard but are also all pertinent to the scientific discussion.

Richdale's monograph is a notable and original ornithological contribution. Whatever is written on penguins hereafter will have to take its base line from this source. There is perhaps no paper in the history of science that has involved such continuous, intimate, and long-term recording of the behavior of a wild animal. Throughout ten years the author seems to have made of himself a penguin with a human brain. On one page he writes: "Between 15 December, 1939, and 5 February, 1940, I camped within a few meters of the nest of the male Z 12 and his mate 115." The context then reveals that he had remained in his observation tent day and night for 52 consecutive days, without ever moving more than a few yards from the spot. Friends who have known him in the field can readily picture the almost incredible vigil, with Mrs. Richdale driving down at frequent intervals to bring food and dry clothing to her consecrated naturalist beside the yellow-eyed penguin's nest!

The book bristles with stimulating results of inductive reasoning brought to bear upon voluminous records of observation. For instance, Richdale shows how the determination of the sex of one penguin that he found dead enabled him to establish, without possibility of doubt, the sex of 59 others in the same colony. This, of course, was because he had banded every one of the residents and had followed their pairings and occasional changes of mates through a series of years.

One could write at great length upon the brilliant exposition of bird behavior in this study. Its usefulness to investigators in other fields is enhanced by the excellent summaries that terminate each chapter.

R. C. M.

THE WEST OF ALFRED JACOB MILLER (1837)

FROM THE NOTES AND WATER COLORS IN THE WALTERS ART GALLERY WITH AN ACCOUNT OF THE ARTIST

----------by Marvin C. Ross
University of Oklahoma Press, $10.00,
254 pp., 200 illusts.

IN a country that has developed as fast as the United States, it was perhaps inevitable that the tide of change and growth should have encouraged and then swept away occupations so rapidly that even their memory has almost disappeared. In 1837 this country saw the peak of two such episodes. In New England, whaling was in its heyday, sending forth its small vessels to all corners of the Atlantic and Pacific and bringing wealth to the owners in their white houses in Nantucket, Edgertown, and New Bedford. In another ten years this hardy, adventurous way of life would begin to disintegrate as kerosene brought a cheaper source of illumination.

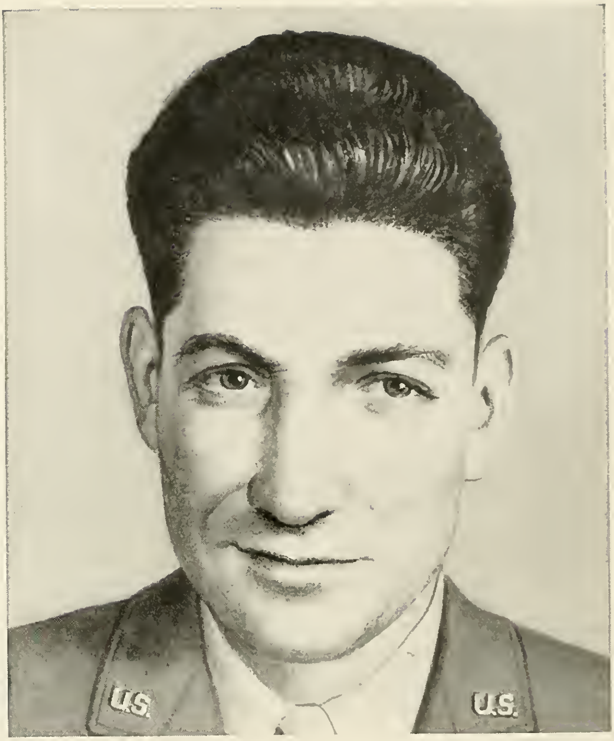
In that same year in the Far West men carried on another occupation, equally hazardous and doomed to an even quicker death. The beaver-trapping mountaineers of the Rocky Mountains were supplying the fur markets of New York and London with their peltries. Huge fortunes, among them Astor's, were being accumulated in the trade. A generation of these intrepid men and the whole thing was over. But while it lasted, the fur trade created a rich, colorful, and highly indigenous form of American life. The difficulties were many. The rugged and severe terrain demanded a high degree of skill and resource to survive. The dangers of the hunt were often fatal, and the Indians only recently in contact with the white man were a constant and devastating threat. To this often grim but basically free and attractive existence, Captain William Drummond Stewart was drawn in 1833. He was a Scot, a soldier, a sportsman, and heir to landed estates in Scotland. For six years he lived among the trappers, traveled with the supply trains, hunted buffalo and bears, and observed the Indians. In 1837 he took with him Alfred Jacob Miller, a Baltimore artist, to record the scenes he came to love and wanted reproduced for his home in Scotland.

Miller made a large but unknown number of sketches during his summer's trip, which were to serve as notes for subsequent more formal renderings. Many of these sketches were copied again and again to order. After his death at the age of 64 in 1874, he was quickly forgotten, just as was the West he had portrayed. Now that general interest in this period of our history has revived, all sources of information on that epoch have acquired renewed value. Miller's sketches are especially valuable. They represent a pictorial rendering of men and things that have all the authority of contemporaneity. They are accurate even in minute detail. And besides all that, they have charm.

The collection, beautifully reproduced here in black and white, consists of 200 water-color sketches, now the property of Baltimore's Walters Art Gallery, together with the comments that Miller wrote on each of them. This is a major contribution to the record of American history.

HARRY L. SHAPIRO

Medal of Honor



Lieutenant Frederick Henry of Clinton, Oklahoma—Medal of Honor for sacrificing himself to save his platoon in combat near Am-Dong, Korea, September 1, 1950. When the platoon could no longer hold its position, Lieutenant Henry ordered the men to pull back. But someone had to stay behind to provide covering fire. He chose to be that man, and was lost.

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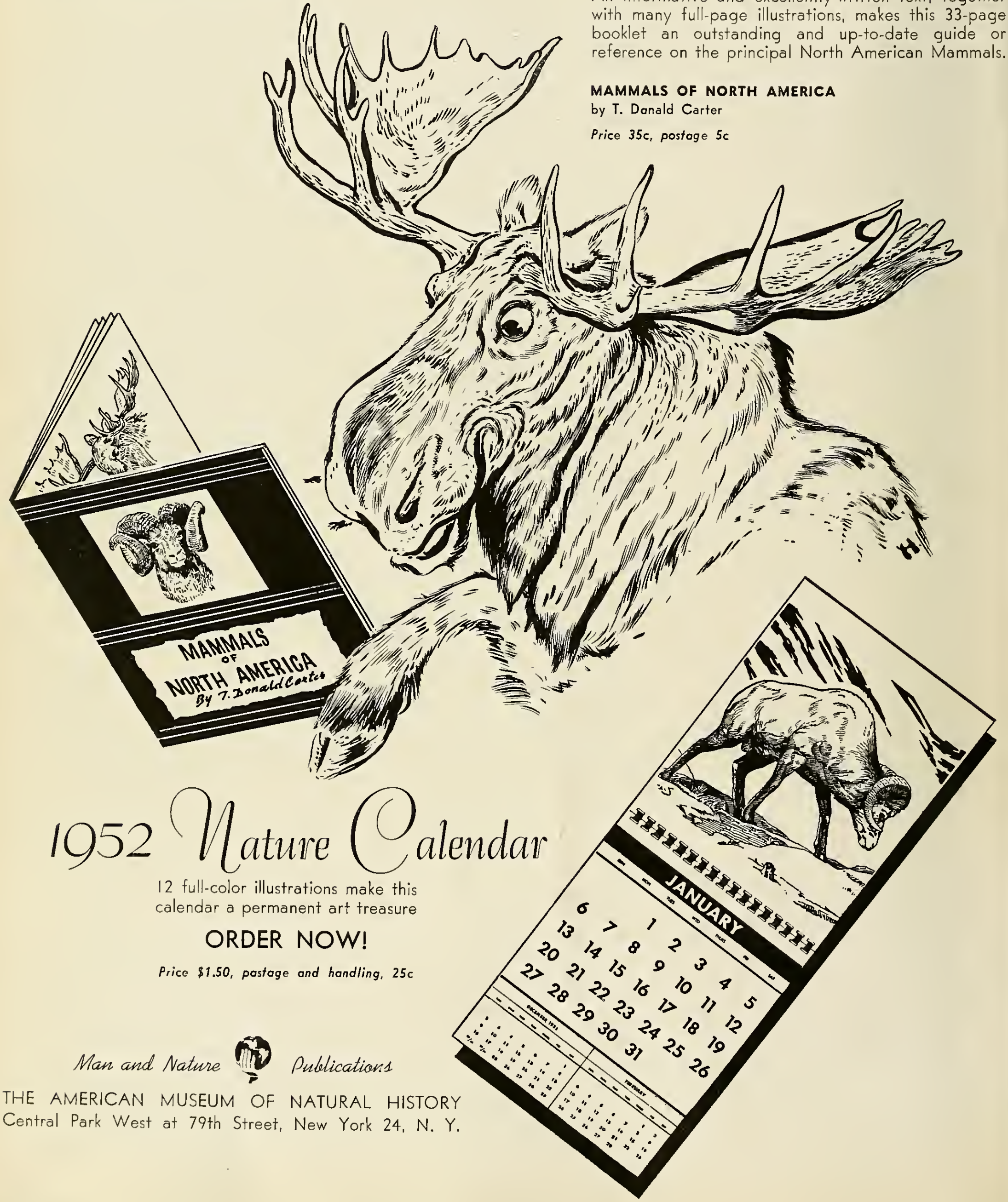
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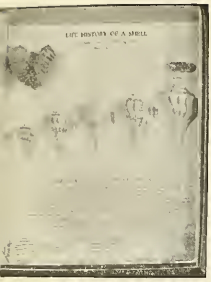
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LETTERS

Penguins are Southerners

SIRS:

My young son, in the fourth grade, asked me why there are no penguins at the North Pole, but I was unable to find an answer in the encyclopaedia. We subscribe to NATURAL HISTORY and enjoy it very much, but rather than wait for an article to appear on penguins, I thought that your files might yield some information on this question.

SHAILER L. BASS

Midland, Mich.

The following remarks are offered by Dr. Robert Cushman Murphy of the American Museum's Bird Department:

This question is not as simple to answer as it may seem.

The reason why there are no penguins in the Arctic may be merely that the birds of this family have never reached that part of the world. Penguins are, presumably, of Southern Hemisphere origin. It is at least possible that the early stages of their evolution were on the Antarctic Continent itself during a period in the past history of the earth when the climate was milder around the South Pole. All the fossil penguins of which we know belong to such Southern Hemisphere areas as Patagonia and New Zealand. The sixteen or seventeen species of living penguins are also Southern Hemisphere birds, although several of them reach the tropical belts and one species occurs on the equator at the Galápagos Islands.

An additional northward journey would still require travel across thousands of miles of ocean water in the Northern Hemisphere. Throughout much of this expanse, food suitable for penguins would be scant because warm ocean water contains much less life than water of low temperature. Then, by the time the wandering penguins had reached the richer Arctic waters, they would find competition from an extremely abundant population of many kinds. The auks, murres, guillemots, puffins, etc., are all members of a single family confined entirely to the Northern Hemisphere, just as penguins are confined to the Southern Hemisphere. The auk family is indeed more or less analogous to the penguin family, even though the relationships are not close. One auk, namely the extinct great auk, was a flightless bird and was originally called "penguin." This is the "penguin" of the famous novel by Anatole France.

And finally, the penguins would not last long in the Arctic even if they should reach it. They are flightless birds, and when they came ashore to nest, they would speedily be wiped out by the wolves, foxes, bears, weasels, and other predatory mammals that occupy most Arctic lands. The Antarctic Continent and the surrounding islands have never been reached by land mammals, which is one of the principal reasons why the penguins have been safe for long ages in that isolated part of the world all around the Southern Pole.

On the Crowninshield Elephant and Old Bet

SIRS:

Dr. R. W. G. Vail, Director of the New York Historical Society, tells me that history fails to disclose what became of the Crowninshield elephant—the first elephant ever to come to America, whose career I outlined in last month's NATURAL HISTORY. Since she had no need of a Christian or pagan name to distinguish her from others of her kind, she was known as *The* Elephant, though it is possible she may have been the Learned Elephant or the Little Bet killed on July 31, 1822, at Chepachet, Rhode Island.

Old Bet, according to Dr. Vail, was the second elephant to come to America. She was an African elephant, purchased by Bailey's brother, a sea captain, in London, 1815, for $20 and sold to Hackaliah Bailey for $1000. This is the elephant recorded by Bentley as killed July 26, 1816 in Alfred, Maine.

GEORGE G. GOODWIN.

American Museum of Natural History,
New York, N. Y.

"Enjoy Them While They Last"

SIRS:

I want to congratulate you on the fine article in the September issue entitled "Enjoy Them While They Last," by Ben East. This is the kind of writing that does some good. . . . Your magazine covers such a broad field, it's wonderful.

MRS. C. C. MARSHAL,
President.

Natural History Club,
of New York City.

SIRS:

If you have any reprints of the article "Enjoy Them While They Last," by Ben East, I would appreciate your sending me a few.

THOMAS PARKER, M. D.

Greenville, S. C.

Sorry, we haven't any.—ED.

SIRS:

The September issue was excellent. . . . I hope the appeal to save the wildlife of Alaska, which was most moving, has a strong effect.

MRS. BRADFORD YOUNG.

Manchester, N. H.

SIRS:

I would like to congratulate Ben East on his excellent article "Enjoy Them While They Last," which appeared in the September issue of NATURAL HISTORY Magazine. As an outstandingly factual account of shore bird slaughter in North America, it makes a strong address both to reason and to the emotions. However, I feel that the article loses considerable force as an appeal for the protection of vanishing Alaskan wildlife because it fails to include certain essential information. Would you, therefore, be so good as to answer the accompanying questions?

JOHN D. BATTENBERG.

St. Louis, Mo.

The questions follow, with answers by Richard H. Pough of the American Museum's Department of Conservation:

1. What is the agency that manages Alaska's wildlife resources?

The Department of Interior, through its subdivision known as the Fish and Wildlife Service.

2. Does it have the necessary full authority to make and enforce regulations governing open seasons and bag limits for all species of Alaskan wildlife?

Yes.

3. If so, why is excessive shooting legal?

Excessive shooting is not legal except insofar as Section 46.31 of the Regulations Relating to Game and Fur Animals, Birds, and Game Fishes in Alaska may provide a loophole which would permit legal killing in areas where the wildlife is not abundant enough to tolerate any kill. This Section reads as follows:

"For emergencies only. An explorer, prospector, traveler, Indian or Eskimo may, when in need thereof and other sufficient food is not available, take animals, birds (except migratory birds), or game fishes in any part of the Territory at any time for food; but he shall not transport or sell any animal, bird, game fish or part thereof so taken; and an Indian or Eskimo may take, possess, and transport, at any time, auks, auklets, guillemots, murres, and puffins and their eggs for food, and their skins for clothing

Continued on page 431

North Atlantic Ocean
WEST INDIES
FRENCH WEST AFRICA
South Atlantic

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VOLUME LX—No. 9
NOVEMBER, 1951

Saintes Island Fisherman.....................Cover Design
From a Kodachrome by Kingsley Noble

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The Versatile Terns............LEWIS WAYNE WALKER 397
Servicemen on the distant shores of oceanic islands can see many species of this unusual bird in action

The Lizard that Swims in the Sand..KENNETH S. NORRIS 404
One of the most spectacular performers of our southwestern deserts

Useful Plants from the Desert...JOYCE ROCKWOOD MUENCH 408
Seeds from all over the world are given a try at the Boyce Thompson Southwestern Arboretum

The Lady and the Cobra........WELDON D. WOODSON 413
An evaluation of the work of Grace O. Wiley, famous snake tamer

Caribbean Fisherfolk Make a Hawl....KINGSLEY NOBLE 420
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The Emperors That Came to Dinner
. H. W. REYNOLDS *as told to* N. PELHAM WRIGHT 422
The longest visit the world's largest penguins ever paid a person

The Redman's Garden of Eden.....ARTHUR L. CENTER 425
A National Monument dedicated to peace where Indians secured the red pipestone for their ceremonial pipes

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THE COVER THIS MONTH

The man we see on the cover lives in the Saintes Islands in the French West Indies. He is a fisherman and is wearing the typical working costume of this trade. His clothes, especially his *salako*, or hat, are copied after the Annamese style of Indo-China. His hat consists of a bamboo frame covered with dark material on the underside and white cotton on top. Although these hats are usually worn by men, sometimes a young man will make a frame for his girl, who may trim the inside with a cotton print and add some ribbon to make herself an attractive hat.

To make the market, Saintes Island fishermen rise before dawn and do the major part of their day's work before eight o'clock. In groups of two or three, they row out against the trade winds seven miles to their fish traps and pull them up from a depth of 30 feet with a vine. Then they poke the fish out with long sticks and return to the beach. The local buyers take their catch to the capital of Guadeloupe before the city customers finish their shopping.

Turn to page 420 for other photos.

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Louise Jacobson, *Assistant in Art and Production.*

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ROCKETS, MISSILES AND SPACE TRAVEL

--------------by Willy Ley

The Viking Press, $5.95, 436 pages
22 photographs, numerous pen-and-ink drawings and diagrams

TREMENDOUS strides have been made in the field of rockets and missiles since 1944 when Mr. Ley wrote his first book on the subject: *Rockets, the Future of Travel Beyond the Stratosphere.*

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". . . When I wrote about the idea of space travel in 1944, I felt it was necessary to put considerable emphasis on the fact that I was serious . . . The question is no longer whether space-travel theory is serious, or whether it is correct. The question is simply how soon engineering practice will catch up with existing theory."

The present volume is a much revised and expanded version of his second book on space travel: *Rockets and Space Travel,* which was first published in 1947.

This book covers three phases of the subject: a historical review from the time of the ancient Chinese to the present, a clear explanation of the major problems involved at the present time, and an intelligent preview of possible future development in this field.

Readers who want to learn exactly where we stand today in respect to such possibilities as orbital rockets, unmanned Moon Messengers with telemetered instruments, and the possibility of three-step rockets that may some day carry a human cargo to the moon, will find the answers in this book. Mr. Ley also explains very clearly the fundamental difference between a projected trip to the moon and to another planet.

There are two appendices. The first contains important data on Rocket Airplanes. The second has numerous notes and tables that include, among other things, current information on rocket societies, the characteristics of various types of rockets, data on the number of meteorites striking the earth in a given period, the probable number of meteorite hits to which a rocket would be exposed in the vicinity of the orbit of the earth, etc.

In addition, there is a large chart in the back of the book that gives pictorially in color the physical characteristics of the earth's atmosphere. The book is well indexed and contains an excellent bibliography.

On reading this volume, some of us may come to appreciate the fact that in the field of rockets, missiles, and space travel, it is later than we think.

ROBERT R. COLES

RETURN FROM THE POLE

------- by Frederick A. Cook

Edited, with an introduction, by Frederick J. Pohl

Pellegrini and Cudahy, $4.50
335 pp.

DURING a few days, in 1909, Dr. Cook was the world's hero; for newspaper readers believed him at first when he told in Copenhagen that he had attained the goal of the ages, had reached the North Pole on April 21, 1908. He was feted by royalty, decorated by universities, received by mayors, and given the freedom of cities. But the immediate skepticism of a few of the experts soon spread to most of the experts and then to the general public. The University of Copenhagen acknowledged it had been hasty; the experts told each other and the public that to believe Cook's story of how he had attained the Pole was an overstrain on credulity. The two Eskimos who had been with Cook changed from support to opposition, retracted their earlier testimony, said it had been concocted and rehearsed, and told in its place a story that fitted known facts. The essence of it, insofar as relates to a polar attempt, is that none was ever made; that instead of a long journey over drifting ice, beyond the sight of land, there had been a coastwise sledge trip, thus southward instead of north, to the well-known game paradise of the Jones Sound district. The winter had been spent living on meat and concocting a tale.

That Robert E. Peary had reached the Pole on April 6, 1909, as told in his 1910 book, *The North Pole,* was in due course generally accepted. That Cook had made up a Robinson Crusoe yarn, told in 1911 in *My Attainment of the Pole,* was the conclusion of nearly everybody, including nearly all the reference works. When Cook's friends, in his name, brought one libel suit after another against the publishers and authors of encyclopedias, histories, and biographies, the suits were thrown out of court. The insufficiency of Cook's narrative, and of his explanations, is thus among the few issues in polar explorations that have been passed on by courts as well as critics. From the heights, Cook went to the depths, and finally to Leavenworth prison for using the mails to defraud—however, on an issue that had nothing to do with exploration.

Cook has always made friends. Peary liked him when he had him as surgeon in the Greenland Arctic in 1891-92; he was the most popular member of the Belgian Antarctic Expedition of 1898-99; in Leavenworth he was nearly or quite the best liked prisoner, with both inmates and staff. After serving only a part of his term he was paroled in 1930 and immediately began that pathetic try for a

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comeback which is represented by the present book. For we are told by the editor: "Dr. Cook wrote *Return from the Pole* in longhand, beginning it in 1930 and completing it in 1935 when he was seventy years of age."

The *Return*, by implication, wants the reader to take for granted that Cook reached the North Pole, thus in effect requiring that we consider as fact the story of how he got back from the Pole, though we had previously been unable to agree that he ever reached it. Nor is the time more propitious for acceptance now, in 1951, than it was when the *Attainment* came out—much less so, for in 1911 it seemed possible that Bradley Land (which Cook said he had seen near 84 degrees north latitude) might really be there. This was still thinkable when Cook finished the *Return* in 1935, and even when he died in 1940; but since then the locality has been crisscrossed by flyers in every sort of weather at all seasons, without any vestige being found of the mountainous land which Cook described and of which the *Attainment* has a photograph labeled "Bradley Land Discovered."

So the *Return*, as far as concerns the alleged polar journey, is neither science nor history. But, like Oscar Wilde's *Ballad of Reading Gaol,* it still may, as literature, help to rehabilitate its author. For the story that the book tells of what happened, really or pretendedly, during the winter in Jones Sound, has something of the Robinson Crusoe and Swiss Family Robinson quality—not probably for other explorers but possibly for readers who have never been to the Arctic.

Vilhjalmur Stefansson

Beginner's guide to attracting birds

- - - - - - - by Leon A. Hausman

G. P. Putnam's Sons, $2.00
127 pp., numerous spot drawings

In this fully-illustrated little book Professor Hausman has brought together information on all the standard techniques for attracting birds and catering to their needs. He has enlivened this material with observations based on his own experiences with birds. In addition to the data on birdhouses, winter feeders, birdbaths, and the like, there is a key to some of the birds usually seen about feeding stations. This is accompanied by animated drawings of the birds. Another useful feature is a list of selected books and pamphlets on the various aspects of attracting, studying, and protecting birds. All in all, this book should prove to be a handy guide for the beginner who is eager to attract songbirds to his premises and to learn more about them.

Dean Amadon

As far as the Yukon

- - - - - by Florence Page Jaques, Illustrations by Francis Lee Jaques

Harper and Bros., $4.00
243 pp., 56 illusts.

The writer-artist team of Florence and Francis Jaques have achieved here a pleasant chronicle, superbly illustrated, of a wandering over the continent. For Mrs. Jaques announces at the very outset that they went from New York to the Yukon by way of Texas.

As a matter of fact, they did even more than that. They returned from the Yukon to New York by way of Vancouver, the Delta waterfowl marsh in Manitoba, and the canoe country along the Minnesota-Ontario border, taking time for a side trip into the Canadian Rockies of British Columbia.

It is the story of this wandering journey that the book tells, simply and without any pretense at the dramatic, but with some very charming passages where the author deals with her favorite subject, the wild flowers she saw along the way.

The yucca-dotted plains of Texas, the Mariposa lilies of California, wild lilacs on Mt. Shasta, the tangled greenery of the Olympic rain forest, the bluebells and lupines of Alaska—these and many more play a major role in this story of a trip that was dedicated to the "collection of wild gardens."

There are also birds and small mammals, mountains and rivers, the narrow-gauge railroads that are of such great interest to the artist half of the team; and now and then interesting fragments of local history creep in.

As Far as the Yukon is a small story, flowing along pleasantly, brightened throughout by the understanding and warm affection in which the author holds wild places and wild things. It is only fair to add, however, that personally this reviewer thought the illustrations much better than the text.

Ben East

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HOW TO KNOW THE AMERICAN MAMMALS

- - - - - - - by Ivan T. Sanderson

Little, Brown and Co., $2.50
164 pp., 25 color plates,
10 pp. of drawings

HOW to Know the American Mammals is designed to give the layman a colorful picture of the mammals living in America north of the Mexican boundary.

In a simple, straightforward manner, Mr. Sanderson gives his version of this interesting subject. There is an outline description of each distinct type of mammal, including its size, color, and habitat. The outstanding characters and specialized peculiarities in behavior of each are emphasized. There are short life histories.

Mr. Sanderson has done a very thorough job and covered not only all the North American land mammals but the whales, porpoises, and seals found in the neighboring seas. To aid in identification, he has included numerous illustrations of the mammals as he sees them and color plates by the famous artist Louis Agassiz Fuertes. He has an entertaining knack of making scientific names popular and easy to remember.

Many works on North American mammals have been published in recent years, but this is the first strictly popular reference book that has attempted to be scientific. It would be difficult to criticize anything specific about this work without checking every statement. Though I do not necessarily endorse all of Mr. Sanderson's statements, his findings are reasonably correct. However, there is a tendency to emphasize extremes rather than averages, which is often misleading.

GEORGE G. GOODWIN

A FIELD GUIDE TO THE BUTTERFLIES OF NORTH AMERICA, EAST OF THE GREAT PLAINS

- - - - - - - - by Alexander B. Klots

Houghton Mifflin Co., $3.75,
349 pp., 40 pls.

THE North American butterflies, birds, and mammals are so thoroughly known to biologists that it is unlikely that more than half a dozen species of each remain unrecognized. Consequently the time has arrived when guides may be compiled allowing field naturalists to recognize every species in these three groups.

Dr. Klots has presented such a manual for the butterflies of eastern North America. He is a Professor of Biology at the College of the City of New York and a Research Associate of the American Museum of Natural History. He is a distinguished authority on North American butterflies, and it is not unexpected that

Continued on page 430

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Can we save the Gray Wolf?

By Edwin D. Neff

On the very borderland of extinction, the gray wolf stirs man with mixed emotions. Will hate or admiration for this symbol of the unconquerable wilderness win out?

It seems only yesterday that the late Ernest Thompson Seton wrote his story of that magnificent outlaw, Lobo, king of the wolves. He told how Lobo evaded every device of man—traps, poison, guns—for five incredible years. How he was finally brought down, heartbroken and the fight gone out of him, through the capture of his beloved mate, Blanca. It was Seton himself who finally trapped Lobo. But he must have realized that even helpless in the traps, the wolf was the true victor. For Seton, reflecting perhaps the compassion of all gallant men for the vanquished, could not kill him. And Lobo, refusing compassion, died, his eyes not on his captor but on the dusty reaches of the New Mexico valley that had been his hunting ground.

Today, Lobo is a symbol for all his kind, for the gray wolf is nearly gone from this country.

Stanley P. Young of the U. S. Fish and Wildlife Service, a top authority, estimates there are fewer than 1000 gray wolves in the United States, a dangerously low figure. And these 1000 are virtually restricted to the northern extremes of three States, Wisconsin, Michigan, and Minnesota, though there are larger numbers in Mexico, Canada, and Alaska.

Yet even on the borderland of extinction, the gray wolf breeds controversy. Cattlemen and hunters want no part of any scheme to protect him. Wildlife conservationists, fearing that an authentic figure of the American wilderness is disappearing, urge that controls stop short of extinction. But, as we shall see, the number of practical sanctuaries within this country are frighteningly few. Most people prefer to admire old Lobo in somebody else's preserves.

His principal enemy, not only today but throughout history, is, of course, the keeper of livestock. Yet bounties are hard to defend in states where livestock is of little economic importance. Sportsmen decry the gray wolf's attacks on game, yet there still are areas within this country where protected game has become so plentiful it is destroying its own food supplies. More consideration should be given to the value of the wolf as a control factor in the normal wildlife picture. In some regions, the wolf's damage to domestic stock might be greatly outweighed by his reduction of game out of balance with its environment.

The problem is clear, though by no means simple. Can a just plea be made for this animal, despite his past depredations, and is there any practical possibility of preventing his extinction?

Even if we had made no mention up to this point of the animal in question, the reader would have had good reason to wonder about him. What nature of beast is this that can stir up such controversy? Why do men hate him and at the same time betray flashes of reluctant admiration? Why could Seton devote every ruse to his capture, then find himself unable to destroy his prisoner?

The key to these questions is the nature of the animal itself. He is the very symbol of unconquerable

AMNH Photo

A Midnight in midwinter on Gunflint Lake in Minnesota: Eastern Timber Wolves in an American Museum habitat group. The northern lights cast their eerie glow over a scene that has gripped thousands of visitors

forces. He gives no quarter, asks no quarter. Few men have tamed him. Though he is the ancestor of man's most devoted servant, the dog, he himself refuses servitude. Given any kind of odds, he can outsmart, outfight man. And throughout this country's history, man has been his worst enemy. Man killed off the wolf's natural food source—game. Then nothing remained but for the wolf to attack man's livestock. And when this happened, man trapped him, poisoned him, shot him. Warfare against the wolf reached the point where his extermination was debated in the halls of Congress. Federal funds were voted to hire professional hunters and to pay learned scientists to plot against him.

Still, hunted and hated, the favorite object of man's wrath, the gray wolf fought on. He trotted deftly around the traps; he sniffed contemptuously at poisoned carcasses; he stayed beyond the range of guns. And in the predawn stillness of the shrinking wilderness his stirring howl indicated to the apprehensive settlers the wolf's indifference to man. Yet man finally won. Or rather his money, his weapons, and his science won, driving the wolf into a comparatively few acres in the northern extremes of the states we mentioned. Once, he had roamed nearly the whole continent, even to within less than 500 miles of the North Pole itself. In the North, the wolf has yet to experience the systematic campaigns of extermination practiced in parts to the south. But from Arctic America come complaints of wolf concentrations, wolf predation, and the initiation of systematic poisoning. And one suspects it may be only a matter of time before even these northern wolves may be on the list of animals threatened with extinction.

The story of this battle to survive is as romantic as the gray wolf himself. But before we begin, let's take a closer look at old Lobo. In general he physically resembles a German Shepherd dog and has a thick coat of hair. Despite the term "gray," individual gray wolves may be almost any color between white and black. Scientists believe these color variations may be due to variations in light, temperature, and humidity in different parts of the continent. Size too, varies. Weights range between 60 and 175 pounds, though the latter size is found only in Alaska and the Mackenzie River country in Canada. His shoulder height may be between 26 and 38 inches.

His efficiency as a hunter stems from a combination of strength, endurance, and exceptional cunning. There is a story of an Arizona female wolf who dragged a seven-pound trap through more than six miles of dense thicket, keeping well ahead of the unencumbered dogs pursuing her and finally doing grim battle with two of the dogs before their master shot her. A Canadian archbishop told a far more amazing story of a black wolf who dragged a steel trap and the wooden block to which it was attached for 90 miles through snow and in bitter cold for 30 days, apparently without food. The wolf was a walking skeleton when finally killed.

Stories of the gray wolf's speed are probably exaggerated. He has been clocked at 28 miles an hour, and while he doubtless can do better for short distances, his famous distance-eating lope is about half that speed. However, he can keep up a steady pace all night.

Wolf hunters say it is not speed but this great endurance that helps to make the gray wolf such a formidable predator. Many of the larger four-footed animals can outspeed the wolf for short distances, but he can run longer. He is not a sprinter but a distance runner, and his patience is infinite.

Even more impressive than these stories of endurance are the examples of his cunning. Newfoundland hunters tell how wolves actually seemed to conspire against their prey. Coming upon a herd of deer, the wolves would divide, a few hiding along the deer trail, while others slipped around to the windward of their prey and chased them into the trail, where they were pounced upon by the hidden wolves.

Stories like these seem to show that the wolf can think himself out of specific situations and is not dependent entirely upon instinct.

The wolf, like all other powerful carnivores, is a capable and ruthless killer. He employs his powers in the most efficient manner, and when there are several wolves in a group they may attack a large animal from every side. If hunting has been poor and the wolves are ravenous, some of them may actually begin devouring an overwhelmed animal before it has died or while it is yet being killed by other members of the pack. Stories told of the ruthless technique of the wolf probably illustrate the extremes to which this predator may go upon occasion, but in the majority of instances the wolf presses for an immediate kill, with few, if any, unusual practices.

Much has been written of the wolf's single-minded devotion to his mate and his family. Unlike most animals, the wolf mates for life, and the young remain with the parents until two or even three years of age. The whelps are born during early spring in dens. By late summer or early fall, when their teeth are coming along, they are taken out to the hunting runway to learn their trade. At first, the parents bring food to the youngsters at resting points along the runway. Later, the youngsters join in the hunt and are taught the technique of the kill. This technique and the hunting methods require co-operation; hence, the family sticks together and may even take on a few stragglers.

There are many stories of this devotion. Lobo's love for his little white mate Blanca is perhaps the best known. His determination to find her after she had been trapped and killed led him straight into an ambush he most certainly would have avoided otherwise and, indeed, had avoided many times. But with Blanca gone he lost his cunning.

Young tells of a reverse situation in which a female, seeking her trapped mate, never missed a night searching the area where he had been caught. After two weeks, she herself was trapped not 20 yards from the spot. In another instance, a wolf family tried to free a trapped

U. S. Forest Service Photos

Typical wolf country in Minnesota, one of the three states to which the wolf is now practically restricted. *Above*: a scene in Chippewa National Forest. *At left:* aerial view looking northward across Sucker and Birch lakes into Canadian territory member by overturning large stones on the snare. The captive wolf couldn't have done it, for both his forelegs were held by the trap.

It is this trait of sticking together that probably has created the myth of the wolf pack, popularly supposed to number in the hundreds. There are early American woodcuts showing a pack of at least a hundred wolves surrounding a log cabin in a forest clearing. The fact is that while several wolf families will band together for a short time, the number is never very large. The usual wolf "pack" consists of a family group and perhaps a few strays.

Another legend is that of the "lone wolf." Young believes "lone" wolves are simply animals grown too old to run with the younger ones, animals whose teeth are too far gone to enable them to fight effectively. These lone animals will follow the others at a distance, eating game they have left. When the old wolf's teeth are gone, he dies, for they are one of his principal weapons.

In his prime, the wolf has perhaps the most powerful bite of any creature near his size. A wolf can take off the tail of a yearling calf at one snap, and there is a case on record where a wolf killed a calf with a single crunch of his muscular jaws, dividing its spine. A male wolf, trapped by a hunter in southern Arizona, severed a two-inch juniper limb with one terrible slash. The hunter was using the stick to push a can of water toward the wolf. Suddenly, the animal struck out like a snake.

"Another inch or two," the hunter recalled the other day, "and he would have taken the calf out of my leg, or maybe snapped off the leg itself."

No wonder then that men have always feared and hated—and admired—the wolf, have fought him with every means at hand in nearly every corner of the globe. In America, it was often a battle for survival. For in a new country, both man and wolf depend first upon wild game, then upon livestock. The battle between men and wolves in this country began almost with the first settler. Indeed, the first reference in our literature seems to have been made by Captain John Smith, that colorful adventurer of England and Virginia, in 1609, the very year that livestock was first brought to Jamestown from the mother country. From that time on, the warfare with the "master predator" was one of the grimmest battles the colonists had to fight. As early as 1630, the wolf had become an outlaw in Plymouth Colony, and two years later the Grand Assembly at James City placed the first bounty on wolf pelts. And bounties still remain in many states.

The Proceedings of the Worcester (Mass.) Society of Antiquity tell how wolves attacked "greatly to the annoyance of the settlers, and many a time did they start in the middle of the night to defend their pigpens and sheepfold, the brave housewife joining in the combat."

George Washington, confronting the same problem that had troubled John Smith more than a century before, speculated that sheep raising might have been one of the most profitable colonial investments except for wolves and wrote to England for advice. Alas, the English experts, unable to visualize America's vast distances, could not understand why the colonists could not fence in their flocks as was the custom in England's tiny pastures!

The war with the wolves continued on through the seventeenth, eighteenth, and nineteenth centuries as the settlers pressed on across the Alleghenies and the vast Mississippi basin and into the Far West. And there a curious thing happened, perfectly illustrating the two sides to this story. In the West, the principal prey of the wolves had been the buffalo hordes. But when pioneers discovered that the grasses of the western plains were ideal livestock feed at no cost, they killed off the buffaloes and substituted their sheep and cattle. That brought them in direct competition with the wolves, for these predators now had no food left except that belonging to man. In the eyes of nature, livestock now became the legitimate prey of wolves.

It was a war to the bitter end. In early Oregon, the famous "wolf meetings" were held. Settlers who could agree on nothing else banded together to plot against the wolf, and from these meetings grew Oregon's Territorial Government. Hence this mighty animal shaped Oregon's history.

Guards, guns, traps, bounties, and poison were arrayed against the wolves. At one time, the use of strychnine reached the point where no rangeman would pass a carcass of any kind without loading it with poison. Cattlemen bought deerhounds and greyhounds to hunt wolves, burned thickets where wolves hid, and formed associations to raise big bounties.

Still, the wolf fought on. The cattlemen had destroyed his buffalo prey, but livestock was easier game, and the wolf prospered. After the turn of the century, frantic livestock men turned to the Federal Government for help, and in 1915, on the eve of war with Germany, Congress took time out to appropriate $125,000 to fight predators. The Federal battle began mainly within the National Forests, but later appropriations covered the grazing lands.

The appropriation of 1915 brought the U. S. Biological Survey, then under the Department of Agriculture, into the picture and thus began the first scientific approach to wolf extermination. The scientists soon turned up new wrinkles. One of the most effective was to kill wolf whelps in their breeding dens. The whelps were literally dug out of the dens and destroyed. The Federal men also discovered that the scent of strange wolves seemed to cause the animal to lose its head. Traps bearing the scent of wolves captured far from the scene were found to have a deadly allure, so that normally cautious animals could be easily taken.

These techniques turned the tide. By the late '20's, the big gray wolf no longer was an economic problem, and the Federal co-operative warfare against him began to peter out. For a time, little attention was paid to the animal, but today there

Continued on page 432

◂ A SOOTY TERN in flight

The Versatile Terns

The tern that balances its egg on a branch and catches several fish crosswise in its bill is only one of the kinds that can be seen by servicemen on distant shores

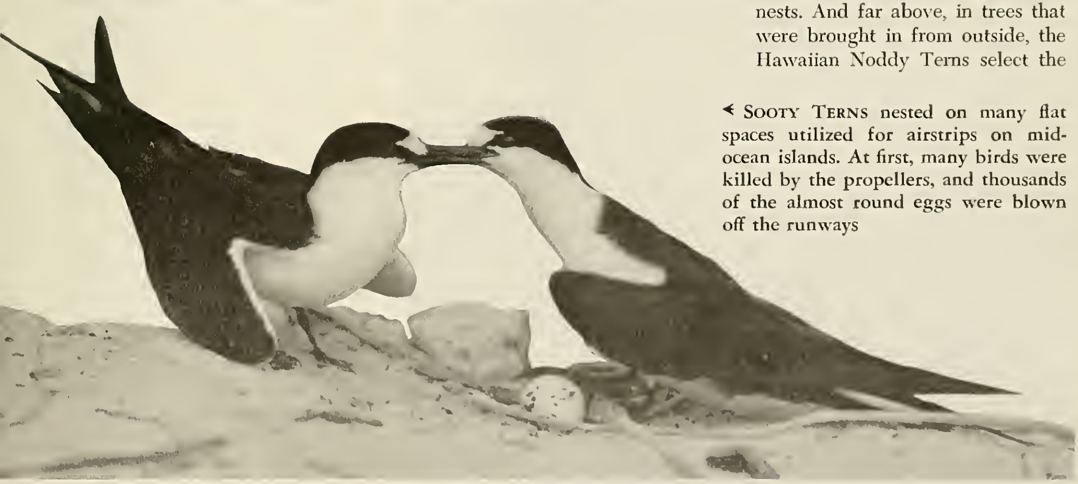
By LEWIS WAYNE WALKER

All photographs by the author

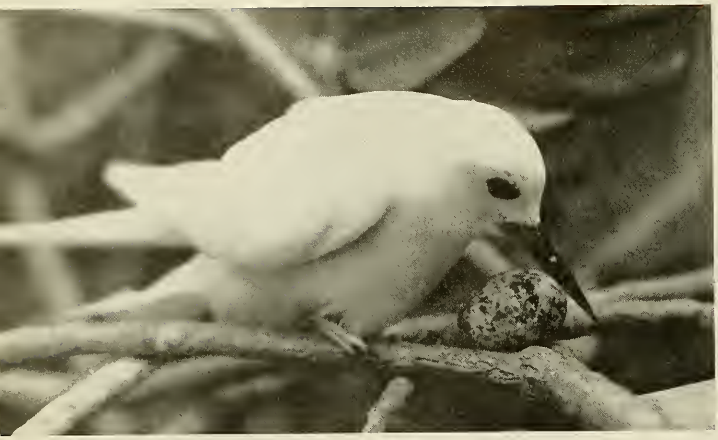
ANY record holder is bound to garner a certain amount of publicity, and it is only natural that the Arctic Tern and its long migratory travels have often found their way into print. Ever since it became known that these birds nest within the Arctic Circle and winter on the fringe of the Antarctic, books on bird travel have called attention to this feat. Even in this age of jets, rockets, and guided missiles, the annual flight of Arctic Terns still holds more than passing interest.

There are other extremists among the tern clan. Each kind shows differences in behavior as well as in appearance—idiosyncrasies that prevent us from applying generalities in regard to foods, nesting, flight, and other traits. And some of these peculiarities, such as the nesting and fish-catching techniques of the Fairy Tern, have attracted special interest among laymen and bird lovers alike.

Midway, that tiny dot of land that was little known until World War II, has several species of terns that call the atoll home and return each year to its coral dust, bushes, and tall trees to raise their young. In some areas the bird population is so condensed that a tenement system is in vogue. At ground level the contrasty Sooty Terns scoop nesting hollows in the sand. Three to six feet above their teeming, screeching numbers, the Fairy Terns, most immaculate members of the tribe, balance their eggs on bare branches without any thought of protective nests. And far above, in trees that were brought in from outside, the Hawaiian Noddy Terns select the



◂ SOOTY TERNS nested on many flat spaces utilized for airstrips on mid-ocean islands. At first, many birds were killed by the propellers, and thousands of the almost round eggs were blown off the runways



▲ A **Fairy Tern** about to cover its egg, neatly poised in the fork of a branch. A gust of wind or the touch of a careless hand is sometimes enough to dislodge the egg

▼ A **Fairy Tern** with food for young

swaying branches and build their robin-like nests.

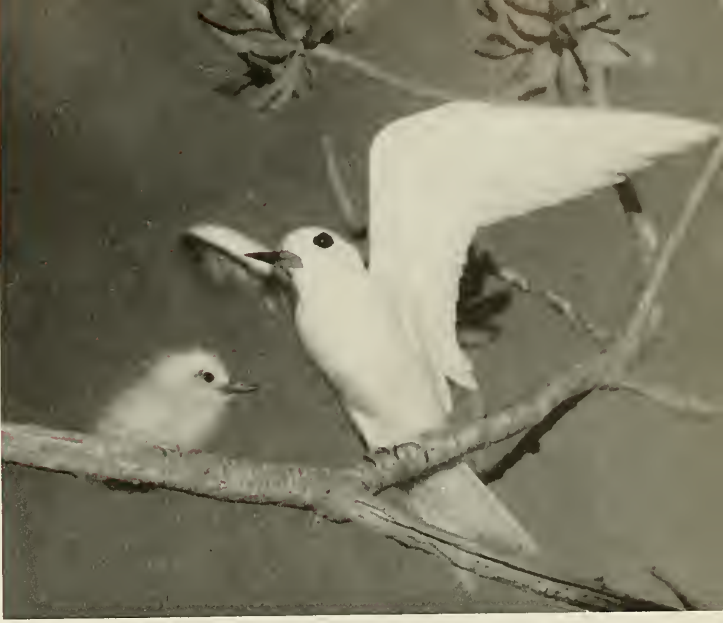
The Sooty Terns, occupying the ground surface of this two-dimensional bird city, have a tremendous range across the breadth of the Pacific and even on islands such as Ascension in the Atlantic.

Many of these mid-ocean islands were needed as airplane bases in the last war, but unfortunately, aeronautical engineers and Sooty Terns both coveted the flat stretches. As a result, we had to deal not only with human enemies but also with feathered ones, for they swarmed upon the runways of many of our island bases. Exigencies of the times almost forced a war of extermination, and a few tern colonies on some of the smaller islands failed to raise any young during the five years of hostilities. The colonies of Midway fared better, and only the terns that persistently tried nesting on the long runway were eliminated.

In 1944, when I arrived on the island, the birds' adaptation to military life had made great strides. As our big transport plane hit the cement, we could see thousands of birds scattering on all sides but very few immediately in front of the whirling propellers. It was almost as though they had learned that this was a danger zone fraught with air currents they could not master. However, island servicemen had a different explanation. They said it was evolution. Some birds flew to the left, some to the right, and some straight ahead. The latter, they argued, didn't survive to pass the trait to their young.

Be that as it may, the moment our motors were stilled, Sooties returned like swarming bees and fluttered to eggs that spotted the ground at two-foot intervals. Some of the nesting depressions were under the wingtips of the transport, and on my first landing I noticed that the nearest birds were hunting aimlessly for missing treasures. At the time, I supposed they were tardy nesters, but a few days later a line of gray several hundred feet from the runway drew my attention. Investigation disclosed untold

➤ An Adult Fairy Tern and young



▼ A Fairy chick at the crotch where it hatched

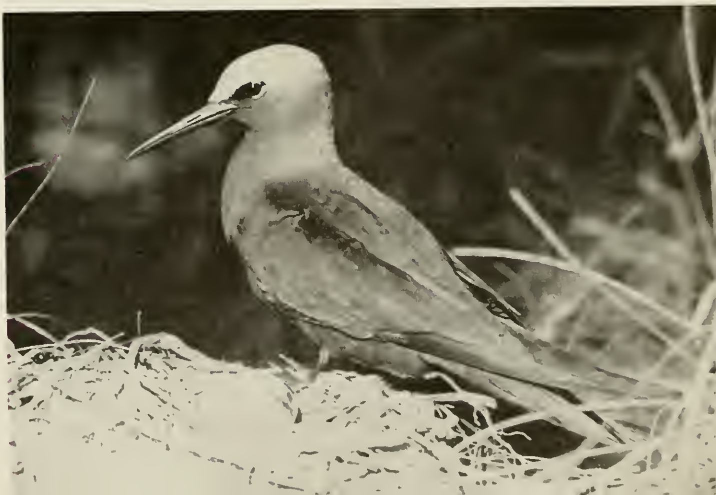
thousands of eggs lodged in a furrow in the ground where they had been blown by the planes! These eggs are almost round and do not enjoy the advantage of murre eggs, which are so lopsided they just roll in circles on the narrow ledge where they are laid.

Sooty Tern colonies create a patchwork quilt over Sand and Eastern Islands, the two that are surrounded by Midway's coral reef. Elsewhere there are messhalls, runways, and a native bush called Sceavilla. The bare branches of this plant are homesites for the Fairy Terns—strangest and most ethereal of the whole widespread tern family.

In comparison with the multitudes of other island dwellers, these "Jap lovebirds," as they were called by the service personnel, were not common. Although they were imbued with the social instincts of most terns, they rarely formed into colonies of more than a dozen pairs. This may have been due to a shortage of the specialized nesting sites. Unlike any other known bird, the Fairy Tern lays its egg on a bare branch! A few will take the precaution of choosing a crotch of a forked limb or the groove formed by two parallel branches. But you will see many that seem to defy gravity, and you wonder how long the egg could remain there if a light wind should rise. I have never seen any sign of nesting material used in the scores of homesites I have examined.

Before hordes of servicemen invaded and settled on these Pacific islands, few White Terns probably lost their eggs in spite of their peculiar nesting system. Whenever I observed Fairy Terns from a distance, they remained constantly on the egg, and it was obvious that the body and feathers of the incubating bird held it securely in place. When there was a change of shifts to relieve the bird on duty, the returning mate would take over with the least possible motion and loss of time. During the war, however, these birds were frequently disturbed.

▼ The shy Hawaiian Noddy is the only tern on Midway that really builds a nest. The upper branches of introduced evergreen trees provide the location, needles the material

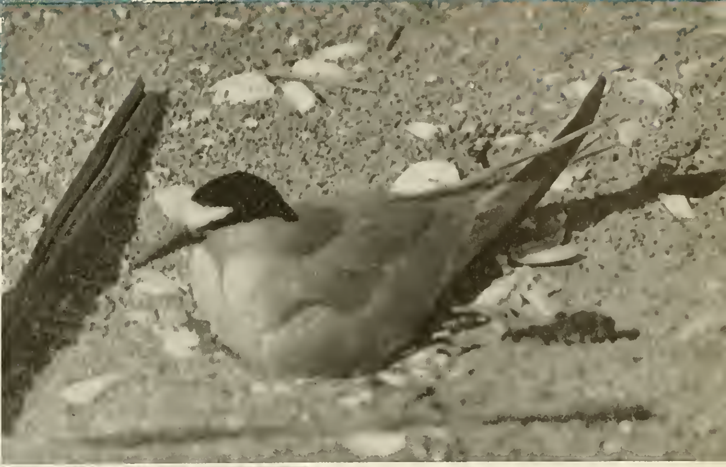


▲ Early in the century, Gullbilled Terns moved suddenly to the Salton Sea in Southern California

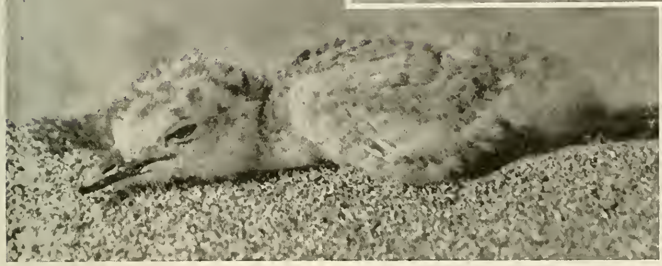
▼ On the Atlantic seaboard, insects had been the Gullbilled Tern's normal food. Here in the desert of Salton Sea, it has turned to eating lizards

And when the bird was off the egg, servicemen learned that, alas, a mere touch of the branch would often cause the egg to roll from its precarious position.

All of the dozen or more species of terns that I have watched from photographic blinds bringing fish to the incubating mate or young always carry it crosswise in the beak. The White Tern is no exception, but instead of a single offering, this species will often arrive with a number of minnows neatly stacked in position. The system used by these terns to hold the first fish caught while making subsequent captures has intrigued naturalists for many years. Though not the first to observe it, a Marine adrift on a rubber life raft during the last



➤ A LEAST TERN on its nest at a beach near San Diego, California. Whole colonies, numbering into the thousands, were completely exterminated along the Atlantic coast



➤ A YOUNG LEAST TERN "freezing" in the face of danger

war had a good opportunity to describe the process. When he was a few miles from an island, several Fairy Terns skimmed the water near by. Tiny fish, presumably frightened, lept out of the water, and the agile terns picked them off in full flight. Fairy Terns were originally thought to do their fishing by plunging beak-first into the water—a method that would make multiple catches a difficult feat.

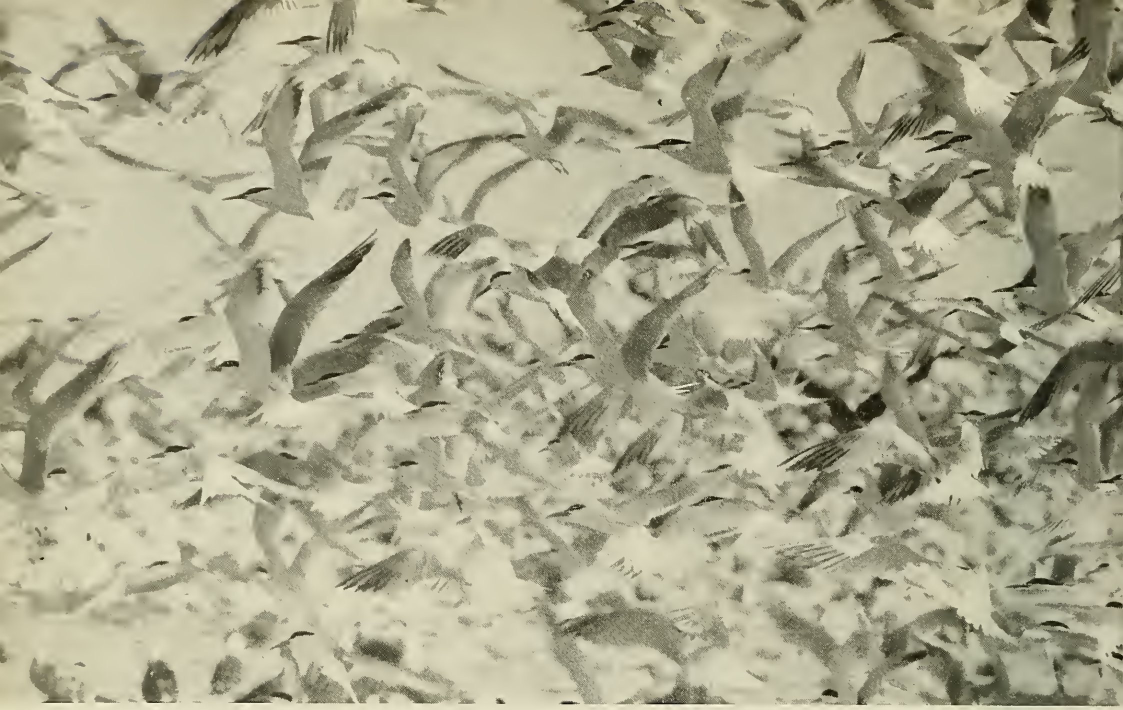
Towering high above the Sceavola bushes of Midway there is a grove of strange evergreen trees, introduced to the island at the start of the century when the atoll became a station on our Asiatic cable line. The upper branches of these trees are the home of a flourishing colony of Hawaiian Noddy Terns—the only terns on Midway that really build nests. Observing Sooties, Whites, and Noddies, I was struck by their sameness. They are all unmistakably terns, and yet in their nesting they are as different as day from night.

The Noddy nests were fabricated from the pliable needles that grow on these trees, and the top surfaces were covered with needles so fresh they were still green. But the foundations of the nests were smeared with ancient refuse, intimating return and re-use each season.

Temperamentally, the Noddy Terns differed from their near-by neighbors, for they completely lacked the noisy brusqueness of the ground-nesting Sooties, as well as the extreme tameness of the immaculate Fairies. Instead, they were retiring and easily disturbed. This was a strange trait to be found on Midway, for almost every other species frequenting the island could be approached and photographed at close range without causing alarm. But the shy Noddy Terns flew from the trees when I began my ascent and failed to return while I remained in the branches.

The sudden arrival and the establishment of breeding colonies by birds that are not normally native to an area is not new in the science of

➤ A LEAST TERN incubating eggs



natural history. As a rule, these wandering settlers encroach by slow stages and are probably motivated by a shifting food supply. But the Gullbilled Terns, now well established at the south end of the Salton Sea, didn't bother to make any slow transition. Early in the century they suddenly appeared on this body of water in the midst of a desert. In this new cactus-covered land, insect food, which had been their normal diet on the Atlantic seaboard, was almost completely forgotten, and desert lizards have taken the place of grasshoppers and cicadas.

The name "Sea Swallow" has been given to most terns because of their swift and graceful flight. But the ones that really warrant this appellation both for size and actions are the diminutive Least Terns, smallest members of the family. At one time these birds had tremendous colonies on the beaches and sandbars along both coasts of the United States. Like the egrets, however, they suffered ruthless persecution in the days when the feather trade was permitted to flourish. Whole colonies numbering untold thousands along the Atlantic coast were completely extermi-

▲ ROYAL AND ELEGANT TERNS in flight

▼ A ROYAL TERN incubating its eggs

nated. Some of the slaughter even reached the beaches of California and Mexico before laws were passed making possession of the feathers illegal. For many years thereafter, the fate of these small terns hung in the balance, and in some areas it was feared that breeding stock, necessary for a comeback, had been eliminated.

On a trip to Cobbs Island off the coast of Virginia in 1927, a party of five of us recorded only a few Least Terns; yet in earlier years the island had had a population that ran into the thousands. Our boatman on that trip told us how his father had described the piles of carcasses. Heaps of birds several feet deep were stacked near the boat landings, and each carcass had only the wings, back, and forked tail removed. By the early 1930's, some of the birds that had escaped death started to fan out and reoccupy their former range. The birds are now re-established on many of their ancient haunts.

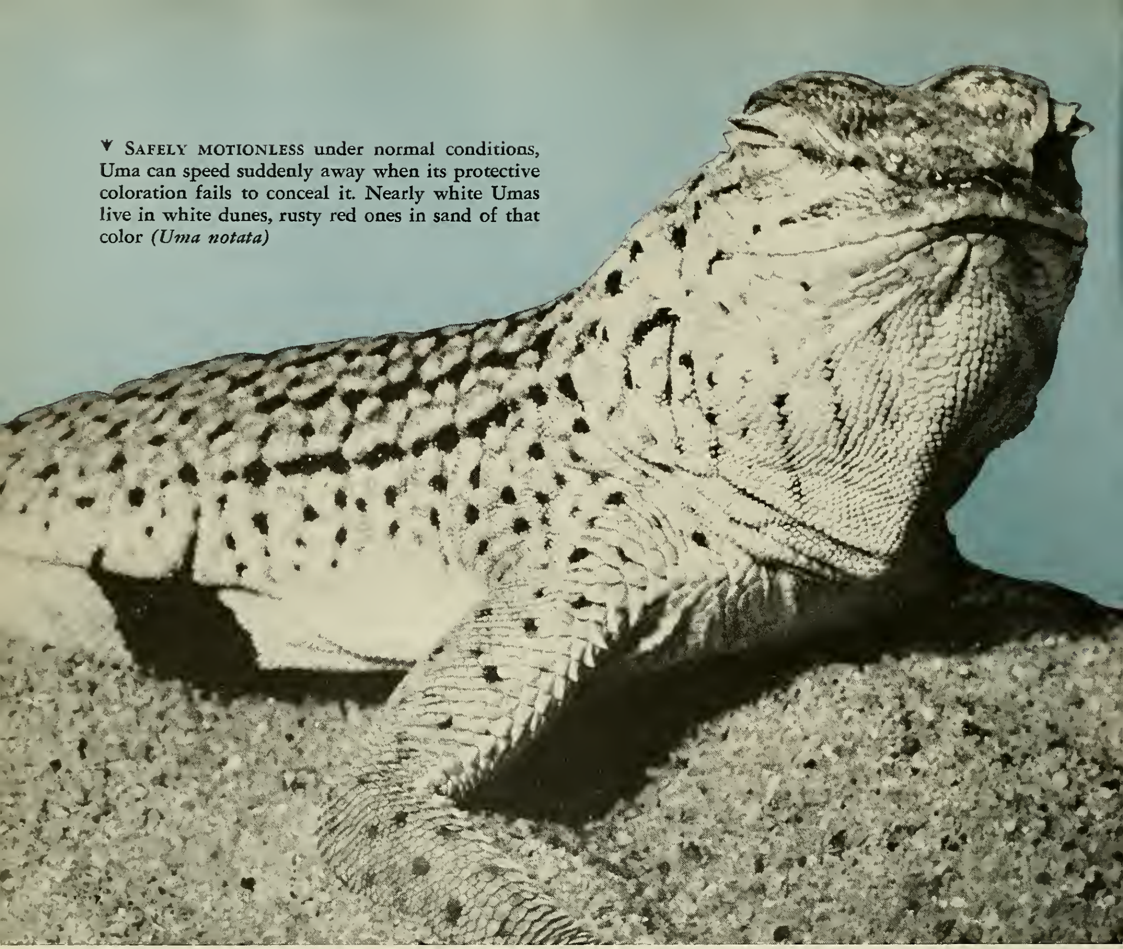
Along the Pacific shores of Southern and Baja California, Least Terns are a constant and familiar sight. During May and June they lay eggs and raise young on the dry sands lying behind beaches that are crowded with week-end throngs of humanity. Despite the hordes that tramp over their nesting grounds, the terns seem to fare well. On several occasions I have seen the adult birds drop to within ten feet of weiner-roasting picnickers and successfully feed their well-camouflaged young.

The nests in a colony of Least Terns are often 20 or 30 feet apart. It must not be supposed that the birds have learned to space their homes for safety from man. The habit is also evident where land enemies do not exist—on low, protected islands.

How different are the rookeries of the mixed Elegant and Royal Terns in the Gulf of California! These rarely visited colonies present a site almost impossible to describe. During the few weeks when the colonies are in full swing, the birds are packed so closely together that the ground cannot be seen between them. On some of the barren desert islands, the nesting areas cover acres of ground, and to a plane flying thousands of feet in the air they show up as silvery ribbons or circles.

A constant parade of Heermann's Gulls encircles these tightly packed masses of incubating terns, and whenever the opportunity for egg-stealing occurs, a waiting gull darts in and out and then dines at leisure. Throughout a day's time, these individual raids account for thousands of eggs, and by nightfall the diameter of the colony will have shrunk many feet. Darkness, however, brings more layers to replace and even extend the borders beyond the mark of yesterday. Thus through an accordion-like, pulsating growth the colony exists, with the terns on the outer edge unknowingly acting as buffers for the final benefit of the species as a whole. While they lay and are robbed and lay again, the birds in the center carry on their household duties, unmindful of the sacrifices being made in the suburbs of their settlement.

▼ An Elegant Tern over its egg in the Gulf of California. These terns pack their nests so close together in colonies with the Royal Terns that the ground cannot be seen between them



▼ SAFELY MOTIONLESS under normal conditions, Uma can speed suddenly away when its protective coloration fails to conceal it. Nearly white Umas live in white dunes, rusty red ones in sand of that color *(Uma notata)*

To most people, deserts imply heat and desolation – a stark world of barren mountains and forbidding sand dunes. The only living things seen by a casual visitor are the few small plants that seem half buried in the sand valleys. The surrounding sand hills stand ready to engulf even these few evidences of life. In sand dune areas a hawk may be seen soaring overhead or an occasional small bird flitting among the scattered bushes, but more likely no living animal will be noted on the dunes themselves.

But closer observation of the sandy wastes of our southwestern deserts will reveal numerous tracks in places not swept smooth by the winds. These indicate that many animals dwell in an area where the visitor least expects to find them.

As you walk between the dunes, you may see a puff of sand 100 yards away, as a small creature, running at high speed, disappears around the end of a dune. This excessively wary animal is Uma, the Fringe-footed Sand Lizard; and usually you will see no more of it than this first puff of sand. But if you follow the lizard's tracks, you will find that they stop abruptly on the slope of the dune. Place your fingers in the sand above this last track and rake down the dune face. The instant you touch the wily little creature you must grasp it or it will burst from the sand and be off, running on its hind legs and only occasionally touching its front feet to the sand for balance. When you capture Uma by this method, be careful not to pick up a resting sidewinder, for this small rattlesnake is often found partially buried in the sand.

Uma's method of burrowing is called "sand swimming." The creature dives into the sand, often while running at full speed, with its front legs pressed against its flanks. Lateral undulatory movements of the body and movements of the hind legs drive the animal into the sand; and rapid vibrations of the tail finally sink it completely. Most "swims" are short.

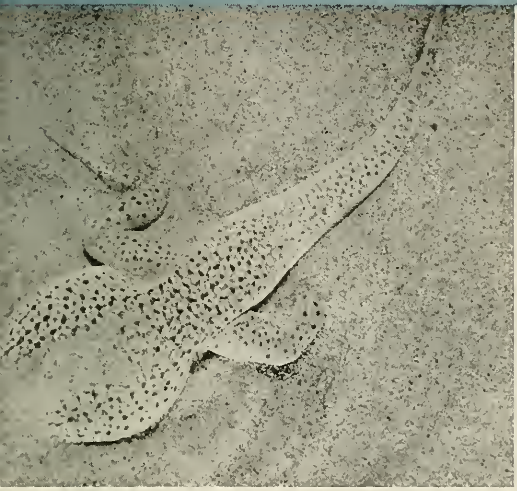
Sand swimming has added a third dimension to Uma's world, for the lizard is not restricted to living on the surface. Uma is remarkably adapted in several ways to its burrowing habits. Its tail and body are flattened, giving the animal a thin appearance when viewed from the

The LIZARD *that* *Swims in the Sand*

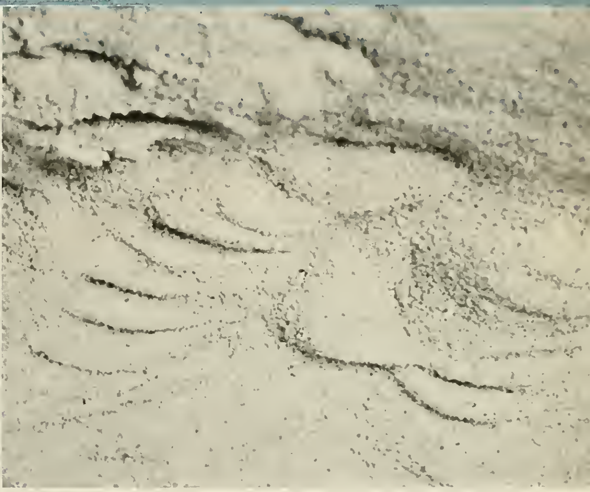
A puff of sand, a dive at high speed, and the Fringe-footed Sand Lizard disappears beneath the surface, in one of the most spectacular performances to be seen in our southwestern deserts

By KENNETH S. NORRIS

Walker Van Riper photos



▲ CAUGHT IN THE ACT of diving, Uma reveals the secret of its disappearing act to the high speed electric flash camera. This photograph was taken at 1/5000 second



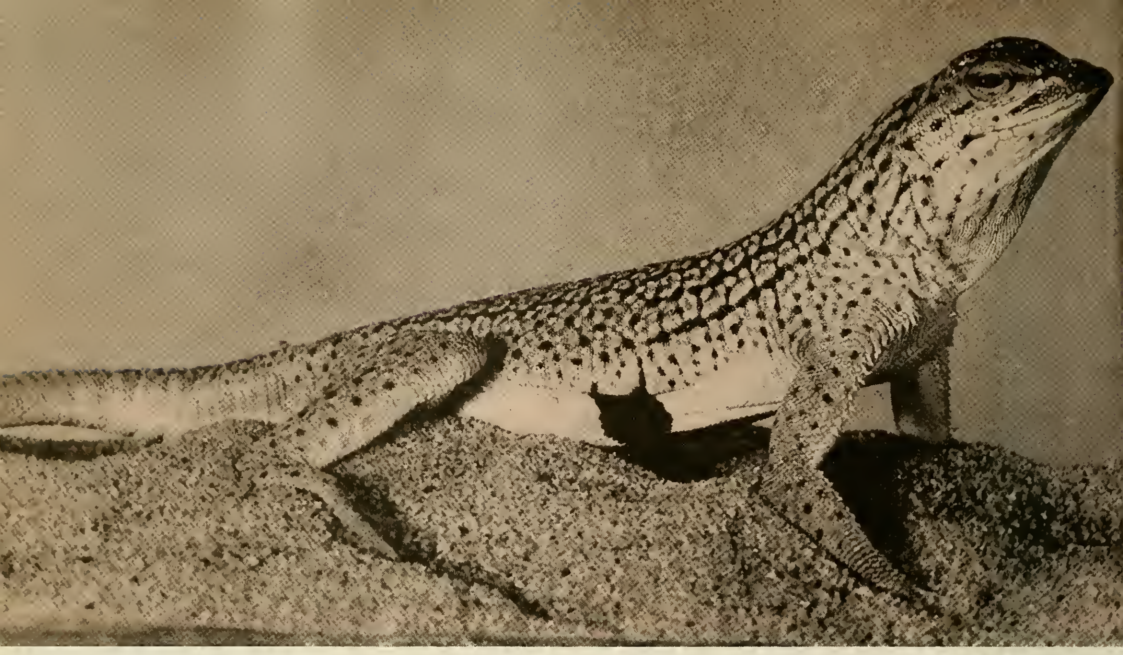
▲ ONLY a pattern of tracks reveals the whereabouts of the lizard. In burrowing beneath the sand, Uma was observed to make exactly the same movements a lizard makes when it swims in water—paddling with the feet and undulating the tail

side. The head is wedge-shaped and perfectly adapted for entering soft sand at high speeds.

Most animals without Uma's protective devices would find dune life rigorous because of wind-blown sand entering their eyes, ears, and nostrils. But Uma's eyes are protected by a series of scales called lappets, which fringe the edges of the eyelids. Under the sand, these are tightly pressed together, preventing the entrance of sand grains. Should sand enter, the grains become moistened and are rolled into a small pellet by movements of the eyes. A blood sinus in the corner of the eye becomes filled with blood and distends the nictitating membrane (present in man as the little knob in the corner of the eye) and thus forces the sand pellet outward. Uma removes the pellet with the toes of its hind feet, which are modified for this action. The nails are flattened, and the flat side only touches the eye, so the delicate eye surface is not scratched.

The nostrils can be closed against the entrance of sand by "valves," which may even permit limited breathing while the animal is beneath the surface.

A short hike through the dunes will be enough to convince most people that locomotion over soft sand is extremely difficult. Yet Uma attains speeds that are remarkable. One time, while driving over a


Walker Van Riper photo

▲ **Uma is not easy to see or photograph. If you search in the heat of the day, he will probably be resting quietly under the sand, with his nostrils and eyes closed against the entrance of sand. The "studio" sand in this picture is coarser than the lizard would encounter in its homeland in the Yuma Dunes of Imperial Valley, California**

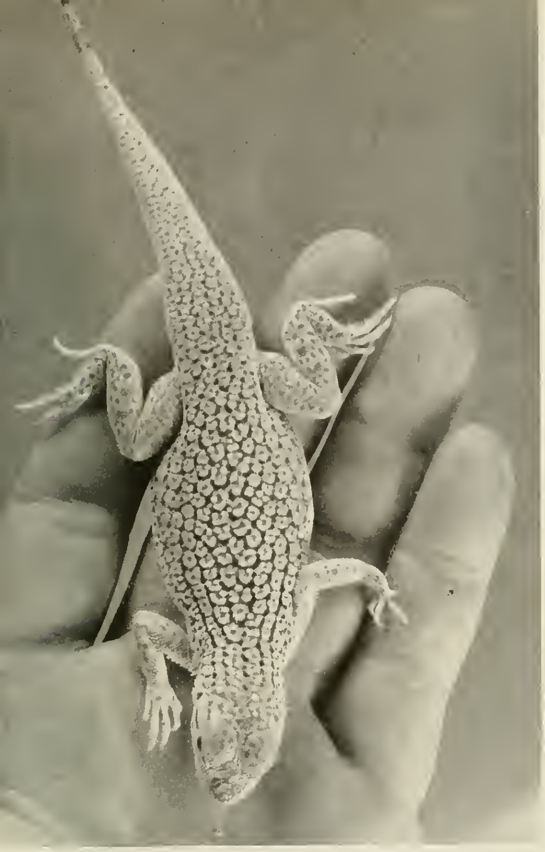
nearly level area of deep sand in a four-wheel-drive truck, a large Uma was frightened from hiding and ran in front of the vehicle. It was all I could do to keep abreast of the swift creature. My speedometer showed that this five-inch lizard was running fifteen miles per hour. At the end of the chase, I was able to pick up the exhausted animal by hand. Uma can run up 35-degree sand dune slopes at such speed that when the sharp crest is reached, you may see the creature shoot several inches into the air.

Uma's common name, Fringe-footed Sand Lizard, is taken from one of the structures adapting the animal for locomotion on sand. On its toes it wears "sand shoes," consisting of long, flat, pointed scales. When Uma runs, these fringes are forced outward and increase the toe surface, thus giving the animal better footing. Some of the toes of the hind feet are extremely long and serve to distribute the animal's weight over a large area, thereby preventing it from sinking into the soft sand.

In the dune areas, the smooth open stretches offer few places where an animal may forage in safety. Overhead, several species of hawks patrol the dunes for food, scanning the terrain with their amazingly acute eyes. On the sand, foxes, badgers, and snakes search for prey. Uma lives almost exclusively upon insects and has no weapons with which to combat these predators. Instead, it relies upon its fleetness, its sand swimming, and its protective coloration, which is truly remarkable. The color and pattern of the animal combine to make it all but invisible on the dunes. Nearly white Umas live in white dunes, and those living in rusty-red sand are so nearly the same color that it is virtually impossible to see them until they move.

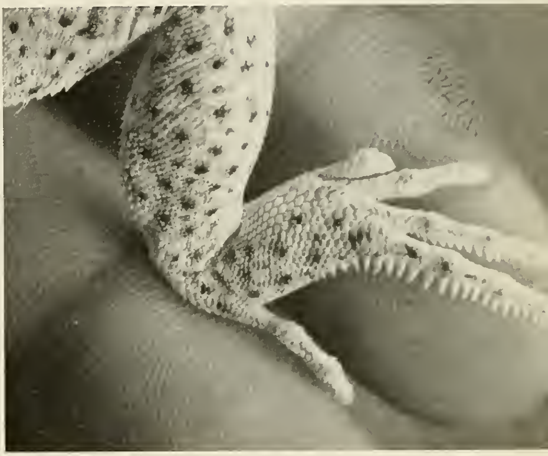
Much remains to be learned about Uma. One of its more perplexing features is the parietal eye. Just behind the level of the eyes, on the top of the lizard's head, is an enlarged scale, called the interparietal scale. In the center of this is a clear lenslike structure. Microscopic examination of this structure shows that it has many of the features of a true eye, such as a lens, fluid cavity, rod cells, and a retinal layer. The function of the parietal eye is unknown. Apparently it is sightless, and it has not been conclusively demonstrated that any nerve connections lead to it.

The notion that deserts are hot is often though not always true. The pursuit of desert animals during the day can be most uncomfortable and sometimes dangerous because of extreme heat. However, a little hunting on the dunes will show that lizards and most other animals do not stay in the sun but retreat underground during the hottest parts of the day. This is not at all surprising when one considers that when air temperatures reach 115 degrees F. at the height of a man's shoulders, the sand surface upon which Uma lives may reach 189 degrees. The lizard remains active and above the surface only so long as there are temperatures that happen also to be reasonably comfortable for man.



< THE FRINGE-FOOTED SAND LIZARD is harmless and most interesting to observe. If lucky you may see it run on its hind legs

∨ UMA'S "SAND SHOE" has fringes of long, flat scales. Forced outward, they increase toe surface on yielding sand



Kenneth S. Norris photos

∨ THOUGH only five inches long, Uma can run at fifteen miles an hour

Useful Plants

FROM THE DESERT

Seeds from all over the world are given a try at the Boyce Thompson Southwestern Arboretum, and the successful plants are given a short cut to fame

By Joyce Rockwood Muench

Photographs by Josef Muench

▲ Cactus bloom. Three gorgeous red blossoms decorate this fine specimen of *Echinocereus arizonicus.* The name means "Hedgehog torch from Arizona"

▼ Fred Gibson, President and Director of the Boyce Thompson Southwestern Arboretum, examining one of the so-called Century Plants *(Agave huachucensis).* The stalk grew the upper two feet above his hand in a few days. Century Plants spend years maturing and then die after blooming and fruiting

Every year quite a number of immigrants, not accounted for in their homeland quotas, enter this country. Making straight for Arizona, they try out the climate, and those that like it settle permanently somewhere in the Southwest. There's nothing secret or illegal about these newcomers. In fact, perhaps you are among some 20,000 visitors who call on them each year and admire them in their new home, the Boyce Thompson Southwestern Arboretum, near Superior, Arizona.

It's an enchanting spot in the desert, with 1700 acres of native vegetation and 30 acres of irrigated and cultivated gardens, set at the foot of Picket Post Mountain, which towers 2000 feet above. The gardens are in the Queen Creek Canyon floor and in coves beside Silver King Wash, at 2400 feet above sea level. More than 3000 varieties of plants grow there.

Graceful eucalyptus trees from Australia hobnob with the Crucifixion Plant of Palestine; Love Grasses from South Africa make no objection to being placed near Russian varieties in this botanical United Nations. Strange and beautiful plants accent the remarkable offering of our own Southwest.

Lovely as the garden is, with spring swaths of Flanders Poppies, golden mists of blossoming Chilean trees, and the cactus family outdoing the rainbow, the Arboretum is much more than just a show place.

The low stone administration building, with glasshouses projecting on either side, lathhouses, library, plant rooms, and all the rest, is the active center of a far-flung network of plant exchange. The institution, unique in its location and purpose, is the gift of a man with a great vision, William Boyce Thompson. His name is linked unforgettably with Arizona's important copper industry, most particularly at Superior, Miami, Globe, and Morenci, and he spent most of his life working with those enterprises. But he saw that the time must come when our mineral resources will be exhausted, whereas our plant resources should be replaced. Research alone would achieve this.

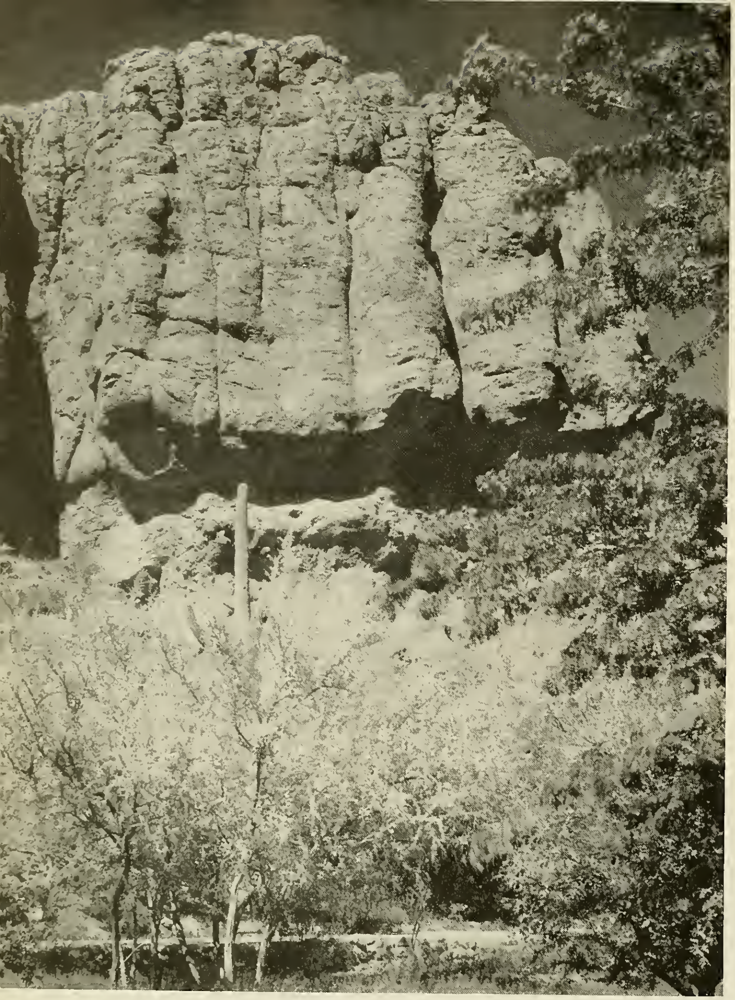
⮝ Near-by Picket Post House was originally built by the founder of the Arboretum, William Boyce Thompson, as his winter home. It is now operated as a guest resort

He knew that of the 52 million square miles of land on the globe, almost half are semiarid. Irrigation cannot reach all of the dry areas. Nor does it need to, he reasoned, if native plants are fully utilized and shared. The great arboretums of the world, however, have been located almost without exception in the deciduous forest belts of western Europe, eastern Asia, and eastern United States, even though that kind of country represents only 12 per cent of all lands. What could be more fitting than to establish an arboretum to investigate the economic and ornamental possibilities of the "forgotten half" of the globe? And where a better spot than this natural garden at the foot of the Pinal Mountains, almost the geographical center of North America's "deserts"?

In 1929 the Boyce Thompson Southwestern Arboretum was dedicated — a privately endowed institution "to bring together, grow, and study the plants of semiarid climates with a view to determining their adaptation characteristics and economic uses." Several years before, Colonel Thompson had founded and endowed the Boyce Thompson Institute for Plant Research situated at Yonkers, N. Y.

Since that date, thousand of seeds have been brought to the Arboretum from far-off points of the compass, and others have been sent to the four corners of the globe as emissaries of goodwill. They travel without publicity, and except for the ones that grow under his watchful eye at the Arboretum, Mr. Fred Gibson, its President and Director, may never know how they fared. Hundreds of different varieties of grass seeds have been tried out, with only several proving of definite value to the Southwest. Down on the Papago Indian Reservation, the Giant Panicum Grass was introduced because it has a protein content equal to alfalfa, and it flourishes without cultivation. The Love Grasses of South Africa and Australia are being used by soil conservation authorities in this country. And Old Man Saltbush provides salt along with its nutrients on cattle ranges. But it is hard for Fred Gibson to know how many of his plant "children" are succeeding abroad.

Little has been said of the current vital research by governmental and private investigators on the lilies, the Agaves, and their relatives. Perhaps from the lily family may come the basis for synthetic



▲ In spring the golden blossoms of the Chilean tree *Gourliea chilensis* make a mist of color below the rough-hewn cliffs

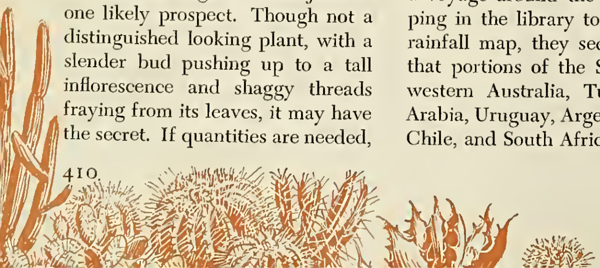
cortisone, the hope of arthritic sufferers. First obtained from animal bile through a complicated 37-step process, the cost of a few weeks' treatment was around $18,000, and there was only enough of the material for a few patients. Samples of various species of the Southwestern Agave are being collected at the Arboretum for study in chemical laboratories. *Agave toumeyana* is one likely prospect. Though not a distinguished looking plant, with a slender bud pushing up to a tall inflorescence and shaggy threads fraying from its leaves, it may have the secret. If quantities are needed, they will be raised commercially, but in these early stages, this southwestern garden is the only source of samples.

Most visitors who come only for the pleasure of seeing the desert in blossom find it a capsule of all lands having similar climates. A walk along shaded paths and into sunny alcoves of the cactus section is like a voyage around the world. Stopping in the library to examine the rainfall map, they see at a glance that portions of the Soviet Union, western Australia, Tunisia, Saudi Arabia, Uruguay, Argentina, central Chile, and South Africa have about the same quantity of rainfall. Ornamentals from the Mediterranean, pomegranates from the African coast, the weird Boojum Tree from Baja California grow beside one another. Every year the Director and his assistant, Bernard Benson, make extensive field trips to gather more varieties of cactus plants. Seeds gathered by mailmen on lonely routes in central Australia, by mining engineers in South Africa, by government workers, and by botanical gardens or students in Belgium, Holland, Mexico, or the Bahamas add to the garden's wealth.

There is a steady stream of botanists, too, many of them coming from other research centers to study. There is a guesthouse and an unusually fine library for their use, as well as the experimental gardens. Recently a professor of systematic botany from Mexico came to learn more about canaigre, or dock, the wild rhubarb. Quantities of seeds are now being picked, cleaned, sorted, and packed to send to him. He is interested in the possibility of growing it commercially, since its sweet-potato-like roots contain tannic acid. Prof. Gustavo A. Benavides hopes it may replace the failing supply of oak bark, which now supplies the tannic acid needed for the tanning of hides.

Mr. Gibson answers personally the many inquiries that come for seeds. When plants have matured and the seeds are ready, they are brought into sheds to be prepared for mailing. All sorts of shapes go through the machine or are cleaned by hand. Carefully labeled, they are then put into coin envelopes, and those not needed immediately for shipment are filed in the seed "library." Drawers reaching almost to the ceiling are filled with future trees, shrubs, cacti, and all the many other varieties of Southwestern plants. They must all be fresh seeds, and perhaps 90 per cent of them will sprout when planted.

Records are kept of various tests on the seeds — how long they keep their ability to grow, how much moisture and what temperatures they will withstand. Incoming visi-



➤ Cacti of many sorts grow in harmony in the glasshouse of the Arboretum. Fred Gibson and his assistant Bernard Benson, on his right, are showing a visitor some of the strange plants under observation

➤ A giant yucca in bloom, *Yucca treculeana.* Its spectacular white panicles form a striking landmark against the desert blue

➤ In bloom, the paloverde tree is a cloud of gold. Countless members of the cactus family line the walks

tors join their American brothers on the shelves or in the rows of plantings in lathhouses as well as throughout the extensive grounds.

The goat nut or jojoba (pronounced ho-HO-ba) shows well how a local son may make good. It grows mainly on alluvial fans at the mouths of canyons and isn't fussy about its water supply. The Indians have been familiar with it for a long time, and an early Spanish explorer, finding it in use for treating skin cancer and as candy and coffee, termed it "California's most precious fruit." Botanically a member of the genus *Simmondsia*, it belongs to the Box family and makes a handsome ornamental hedge. But its industrial possibilities are even more outstanding. The nut contains a useful liquid wax which, when hydrogenated, is second in hardness only to the expensive carnauba. The Union Oil Company holds patents for mixing it with lubricants. Other patents cover its use in bubble gum, cloth, linoleum, baked enamel, and printer's ink. It can be used as an ingredient in ready-to-bake cakes and cookies, because it increases stability against rancidity. It can be repeatedly heated to 500 degrees without change in viscosity.

Seeds of this shrub with its leathery, gray-green foliage have been sent from Superior to Texas, Mexico, Cuba, the Bahamas, Chile, South Africa, and Australia. Commercial plantings are being tried. It requires about 10 years of growth before the nuts mature in quantities, but the plant needs little irrigation and will grow on submarginal lands where there isn't enough water for most other crops.

In a world where monetary considerations seem sometimes to crowd everything else out, the very atmosphere of the Arboretum is refreshing. You can't buy a single plant or seed, but you may have them for research or experimental purposes. Paths stretch for a 25-minute stroll along the Green Labeled Tour through Queen Creek, among lovely native and introduced shrubs and flowers, or you can take a 15-minute journey along the Yellow Tour in the Cactus Garden and Ayer Lake, actually a botanical view of half the globe.

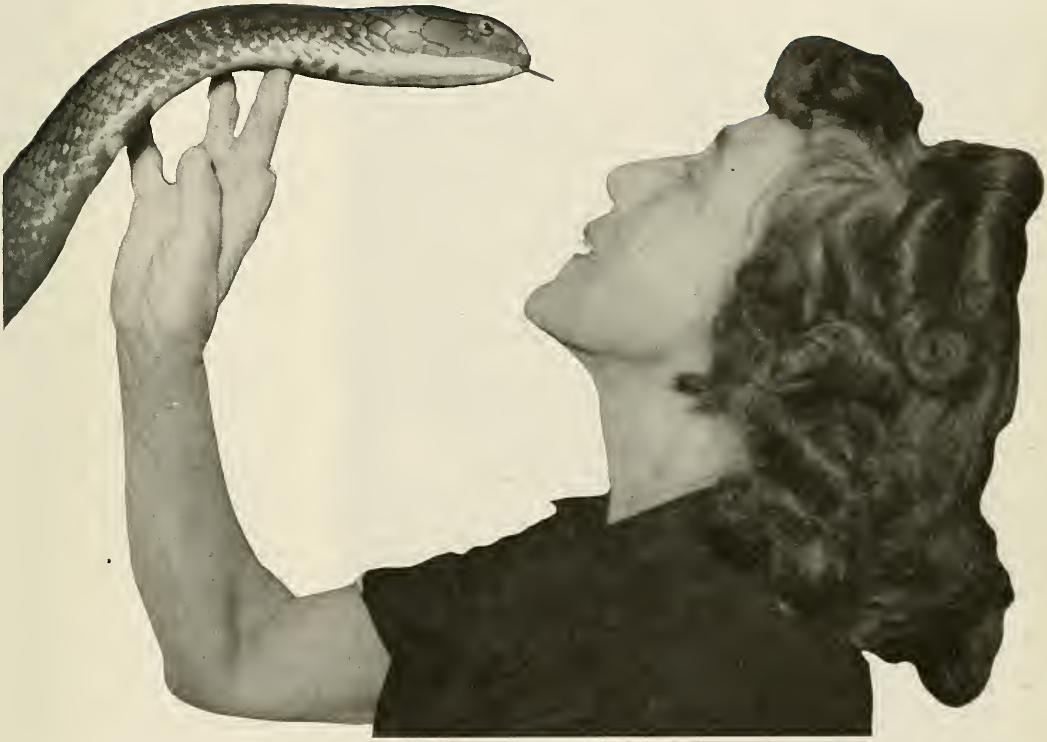
Overlooking all this is Picket Post House, built by Colonel Thompson for a home. After his death, the Arboretum sold the property, and it is operated as a guest resort, with views into the gardens and trails leading back into the mountains. Since the area is also a wildlife sanctuary, plants are not the only things to see. The variety of foliage and fruit attracts an unusual number of birds, and there are porcupines, bobcats, skunks, rabbits, and even some mountain lions, deer, and javelina.

Whether judged in terms of its functional beauty, or of the work that is going on there, the Boyce Thompson Southwestern Arboretum is realizing the vision of its founder, who said in planting a small saguaro, "Grow and bless the world."

⮝ EUCALYPTUS GROVE. Far from their native Australia, the Boyce Thompson Southwestern Arboretum is cultivating these handsome trees to learn if they are adaptable to other arid environments

Grace O. Wiley was the most celebrated snake woman of our time. Were her achievements in taming venomous snakes scientifically valuable, or will posterity call her only a first-class showman?

The Lady AND THE Cobra



By Weldon D. Woodson

Photographs by Newton Berlin

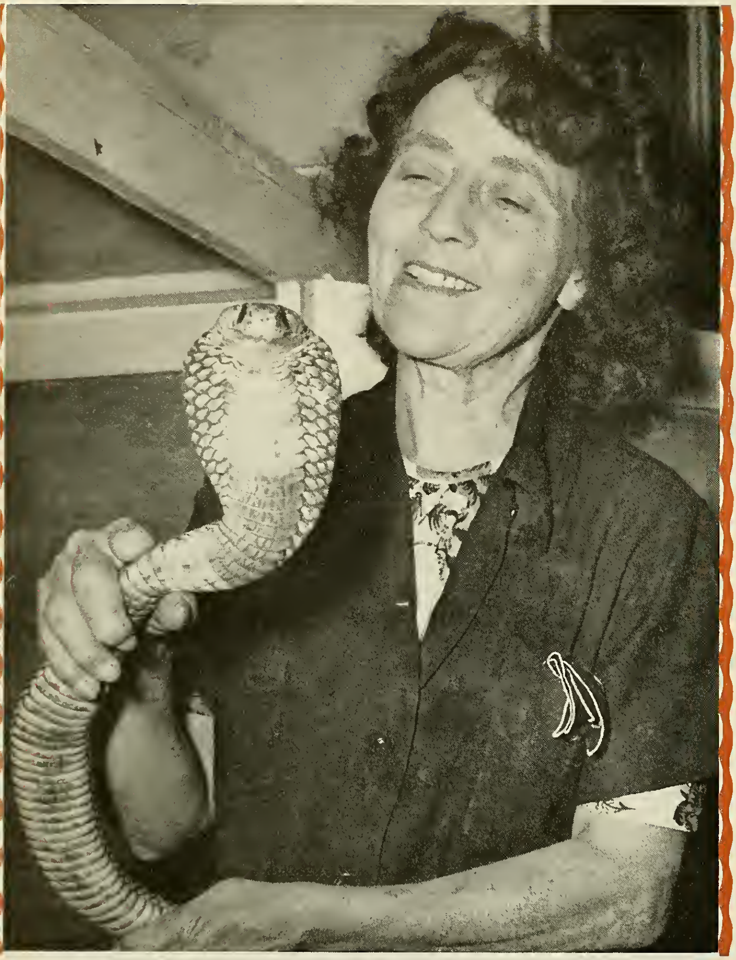
▲ GRACE O. WILEY demonstrating how she tamed her favorite, King, a deadly king cobra. His fangs are intact; a bite would mean sure death

"SNAKES are the underdogs. So many people dislike them. Yet, if handled with kindness, even the poisonous cobra will harm no one."

This is what 64-year-old Grace Olive Wiley would tell visitors to her reptile zoo at Cypress, California, 25 miles east of Los Angeles. To prove it, she frequently posed in pictures with her lethal charges.

As was her custom, on a day in July, 1948, she permitted an interviewer to photograph her with a deadly Indian cobra. This snake, however, had been acquired only lately and was not used to being handled. As she attempted to coax it to spread its hood, it drew back, then bit her on a finger. About an hour after the bite, she died in a hospital. Among her last words were instructions on how to care for and feed her animals.

Every movie-goer has seen her giant pythons and cobras on the screen. Her foremost star, King, was a fifteen-foot king cobra from the jungles of India. He and others brought chills to your spine in the



▲ **Brownie**, an Egyptian cobra, with his hood spread. Mrs. Wiley excused his nervousness on the grounds that this was the first time he had been photographed

Tarzan pictures, "Trade Wind," "The Jungle Book," and "Cobra Woman."

Remember "Moon Over Burma" and that cobra that "menaced" the blind plantation owner portrayed by Albert Basserman? These cobras were from Grace Wiley's snake farm. By "cobras," it is meant that there were two, although, quite surely, you thought you saw only one. You see, a pair of "tamed" cobras from Siam, named Illa and Indra, were on the motion-picture lot—under the care, of course, of Mrs. Wiley—and alternated before the camera. When Illa was exhausted, Indra took her place, and vice versa. They looked so much alike that when the picture was finished, no one except their trainer could tell them apart.

When my wife Freada and I made our visits to her zoo, Illa and Indra were no longer there, but King and his companion Queen were conspicuously present. Not to be overlooked was a thirteen-foot python referred to as Rocky, which I helped to handle, as well as his associate, Juniper. The skin of the latter, as is characteristic of some snakes, reflects a beautiful irridescent color. Mrs. Wiley called attention to this, then quoted from memory a passage pertaining to it from W. H. Hudson's *Green Mansions.* Various kinds of reptiles were in the barnlike structure back of her small cottage. A crocodile with the title of Mr. Ferocious, an alligator tagged Johnnie, spiny-tailed Egyptian lizards, Mojave Desert sidewinders, Egyptian vipers, a West Indian fer-de-lance, cobras from Egypt, vipers from Italy, and a krait from India—these will indicate the range of her collection.

We spent a number of sessions with her. One, I shall always remember. With me as I drove in front of the Wiley cottage were photographer Newton Berlin and my wife. We had no more than gotten out of my car when out of the house came Mrs. Wiley, her 87-year-old mother Mrs. Mary Gough (known to her many friends as Mother Mollie or Auntie Mollie), and a six-foot monitor lizard from Java, christened Slinky.

With Slinky, as he lumbered along, in the lead, we proceeded to the reptile house. When the door was opened, he bolted in and scrambled straight for the great wooden box underneath a platform of smaller cages. Before he could escape, Mrs. Wiley hauled him back so that we might look him over. To tell the truth, he seemed not the least interested in making our acquaintance. When we witnessed the last inch of his tail disappear, we knew that that was the end of our friend for a while.

After we had pretty nearly made the rounds of her glass-fronted cages, Mrs. Wiley asked in a quiet but dramatic manner, "And now, would you like to see King?" There was a sort of triumphant tone in her voice. And well it should be, for her experience with this snake —the deadly king cobra, or hamadryad—has no parallel.

Not too near, but close enough to watch her, we stood as she tenderly eased his long, graceful body out of his cage. For you who think that his fangs were pulled or that he was regularly milked of his poison, let me state that that was not the case. She did not tamper with the poisonous apparatus of any of her venomous snakes, for to do so, she pointed out, would be injurious to their health. Yet, with their fangs intact, she handled them unafraid!

In catering to King, however, she drew the line when it came to feeding him a preferred diet—other snakes. To her, a snake is immaculately clean, friendly if you meet him on his own level, and worthy of as much interest and study as a pet dog or cat. When handling one, then another, she would wash her hands—not for her own sake but to prevent the spreading of any possible contagious disease among her reptiles. She valued each one that much.

Consequently, she refused to sacrifice a single one even to satisfy King's cannibalistic appetite. She substituted choice Swiss cuts of meat at first, but this became impractical when their price skyrocketed. In place of this, on a bamboo stick, she would thrust down his throat small chunks of horse meat covered with cod liver oil and bone meal. Her success in force-feeding King is attested by the fact that he had thrived under her care, along with Queen, since August of 1934.

With the help of Mother Mollie, Mrs. Wiley worked King out of his cage. He was of such a great length, however, that with his trainer at the dangerous end, the head, and Mother Mollie holding him up in the center, a full third of him was left hanging awkwardly down onto the floor. I sensed the unshapely setup; so did Newt and Freada. For the sake of suitable pictures, I reluctantly supported the tail end as he weaved to and fro; and once he nudged his nose against my hand.

The inevitable question is how did she come to handle poisonous snakes so intrepidly? Did she always like them? The answer is startling. As a child in Kansas, she had the same fear as is common with other youngsters—not natural but conveyed by adults. Even as a young entomology student at the University of Kansas, she had an abject horror not only of poisonous snakes but even of the harmless ones. On field trips, fellow "bug hunters" laughed at her when she jumped back in fright as a baby garter snake scurried through the grass.

As an entomologist, therefore, she hoped to make her contribution. She married, but it did not work out. While still with her husband, however, she went with him to Texas, where she collected insects for the University of Kansas. Subsequently, she organized nature classes among children, wrote articles on insects, and gave talks. Her enthusiasm for entomology can readily be realized from the fact that her name is perpetuated in the names of nearly a dozen insects.

During this time, she determined to conquer fear of snakes. Soon she was able to handle the harmless ones like other naturalists. In 1923, she became Curator of the Museum of Natural History, Minneapolis

➤ GRACE OLIVE WILEY with her pet python, Rocky, who appeared in many motion pictures

Public Library. Here, she maintained a collection of live reptiles. While talking to a visitor one day, one of the rattlesnakes crawled across her hand. This instilled in her the desire to "tame" poisonous snakes.

She invented a petting stick, which consisted of a pad of cloth tied to the end of a short bamboo feeding stick. She would stroke them with this. Shortly, she could pet them with her hand.

To "tame" King and Queen upon their arrival in 1934, she employed two three-foot sticks. One had a heavy wire at the far end spread out in a U-shape. This stick was to be held in the left hand as a shield to push the snake back if it attempted to rush out or strike. The other—the petting stick—was padded at the end with a soft cloth, with which she would gently pet or touch the reptile.

▲ **The author** on the "safe" end, with 87-year-old Mother Mollie holding up the middle. This is Grace Wiley's favorite, King, and she shows no concern within inches of its fangs

▼ **A close-up of Slinky,** the six-foot monitor lizard from Java, with his tongue out

"At first," she writes, "the kings were so excited and touchy, they snorted and blew, reared, spread, jerked, and twitched, when the padded stick touched them." They refused the various kinds of food placed in their cage. The fifth day after she started petting them, she was able to force-feed the smaller cobra, Queen, and the next day, she succeeded with King. At this time also she began to handle them. On October 23 of that year, she helped King to shed his skin, even pulling off the eyelids with small forceps. After stroking and petting him about the head and neck, she rested his head on one hand with him facing her. "He was unafraid and put out his tongue in such a knowing manner," she commented.

In reflecting over Mrs. Wiley's tragic passing, the question arises: Did she make any significant scientific contributions? Quite surely, she fell far short of her goal. She desired to make the Cypress Reptile Farm one of the largest of its kind, to which not only the public but herpetologists the world over would come. Travelers to India, she lamented to Freada and me, went there to capture or kill animals, not to make their acquaintance and study their ways. Her greatest ambition was to go to India's jungles and "tame" cobras in their natural haunts—replicas of her charge, King. She planned an autobiography that would detail her experiences and findings, but she wrote only a few paragraphs—the opening, or preamble, one might say—which she read with sincere fervency to us one night as we sat on a sofa in her cottage.

One may well wonder, however, whether her inductions were not motivated by the heart instead of the mind, with a bias for the snake and without objective observation. How intelligent are snakes? Obviously they have vision, but do they have any power — other than to detect vibrations, temperatures, or odors — with which to discern the near-by presence of a being? Can they recognize one human from another? Have they memory? These constitute some of the questions she was frequently asked.

Consider a portion of her answers, culled from her paper, "Taming King Cobras."* "Snakes are very intelligent and 'catch on' much sooner than we do to indications of sympathy—that is, they are not, as a rule, afraid to trust you first," she states. Then, there is this from her published notes on force-feeding a pair of king cobras: "I am positive that they know and recognize me." And in another place, referring to the various poisonous snakes she has "tamed" (including thirteen species of rattlesnakes, the Australian tiger snake, and the Gaboon viper), she sums up, "Somehow they know very, very soon that I am friendly, and that I like them. They appear to listen intently when I stand quietly at their open door and talk to them in a low, soothing voice. In some unknown manner my idea of sympathy is conveyed to them."

Needless to say, herpetologists have challenged the implication of these statements. There is little to be gained by saying that "snakes are very intelligent" and "catch on much sooner than we do to indications of sympathy—" or that "I am positive that they [her cobras] know and recognize me," unless some evidence is provided to substantiate such conclusions. Contrast her intuitive methods with the traditional methods of science in recording observations and comparing them with other data so as to derive a tentative conclusion. Her frequent use of "I am positive" and its equivalent in conversations is contrary to the attitude of the true scientist who, after first presenting the facts, couches his conclusions in such guarded language as "it seems," "this would indicate," "probably."

From my own limited firsthand observations of her work, I was persuaded that goodwill toward her subjects sometimes prompted unscientific judgments. As we have watched Mrs. Wiley fondle her exhibits, calling them by endearing names as one does a pet dog, we could not help but note that an action she hailed as a response to her beckoning seemed more of a coincidence. If there was no apparent reaction when addressing or caressing an animal, this was ignored or excused in one way or another.

She claimed that, although she experienced about 40 bites, none came from "tame" animals. All allegedly were from newly-acquired specimens—those which she had not put through the patient process of becoming accustomed first to the petting stick, then to her own hands. Poisonous snakes are not "vicious or mean," she contended, "but only afraid, panicky, terror-stricken, like a frightened bird or mammal at first."

Even the then freshly-obtained Indian cobra that inflicted the deadly bite became "tame" due to the attention of Wesley H. Dickinson, who when a youth was — as she liked to call him — her "protégé." He, likewise, handles with his bare hands the "tamed" poisonous creatures. It should be emphasized, however, that he is cautious and scientific in his conclusions.

Not long after Grace Wiley was fatally bitten, Freada and I drove up to the Reptile Gardens, Phoenix, Arizona, owned by our venerable friend, Charles L. Evans. After his enthusiastic greeting, and as we looked at sundry cages that contained recent additions, we asked him if he had read about the Grace Wiley case. Smiling, he pointed to a cage and said, "There's the cobra." Not only did he exhibit that one but others that we had seen at her zoo in Cypress. Like most of mankind, Evans, despite — or, more accurately, in view of — his many years of familiarity with reptiles, looks upon the venomous kinds as dangerous and handles them with tools.

One may remark, "Why wasn't the cobra killed?" Mrs. Wiley, herself, would have been the first to protest. Indeed, after it struck, she took the fangs from her finger, gently held the reptile with both hands, and returned it to its box. It was the first time it had been taken out of doors, and it became nervous. "They strike in defense only when frightened," she would often say. One must add that they may also strike when hungry. In view of the fact that she force-fed many of her snakes, however, the creatures probably never had an opportunity to strike at their prey.

From the human-interest standpoint, which the press played up, this cobra had a letter "G" on its back, whereas most cobras of this type have an "O" marking. The "G" is distinct, as I personally could see upon my visit to the zoo when Dickinson brought the snake out of its cage and showed it to me. Since Mrs. Wiley's given name is Grace, beginning with "G," I have been told that she thought of it as a good omen. Instead, so the newspapers wrote, the "G" mark was a "morbid prediction of its fatal association for her."

Over a long period of years, she tended with her bare hands some of the world's most poisonous snakes. It is not surprising that she experienced approximately 40 bites. Many will say that this alone disproves her claim. Any of these bites might have been fatal. She always said that only the "untamed" snakes ever bit her. But in view of her tendency to shut her eyes to anything unfavorable toward her captives, one may well wonder whether the very fact that a snake attacked her was not accepted as proof that it had not been "tamed." Finally, any experienced keeper knows that once a snake has become accustomed to conditions of captivity and the presence of people, it can be handled, but never without some risk.

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* NATURAL HISTORY Magazine, January, 1937.

It has been stated that with her "tamed" poisonous snakes, she achieved much that was beyond that of other curators of reptile zoos. She bred rattlesnakes in captivity, a feat carried to the second generation. Instances have been known where the rattler, ensconced in a dark box away from the public, has given birth to young, but hers were in their cages exposed to the passing throngs. Here, they have gone through their life cycle, apparently unhampered by this unnatural environment. When force-fed, reptiles generally don't fare too well in captivity. In contrast, her specimens tended to be exceptionally healthy and long-lived. Zookeepers must use sticks in tending venomous snakes, but her dependence upon her hands gave freedom that wrought surprising results.

In commenting on this, her success in maintaining many of her captives in a healthy condition has been duplicated by zookeepers and others willing and able to devote the time to it. As one herpetologist has summed it up, what Grace Wiley did as a snake handler, anyone could do if he were "silly enough" to take the chances that she was willing to take.

On the other side, it has been asserted that by means of the lecture platform, magazine articles, radio, newsreel, educational film, and major studio motion-picture productions, she has contributed much in popularizing "facts" about snakes. She has been credited with having inspired hundreds of young herpetologists to overcome the prejudices that have generally existed toward snakes. She was an expert in herpetological photography, and, among other features, of the life history and habits of snakes. She took the first motion picture of a rattlesnake shedding its skin.

Actually, though, it can be seriously questioned whether she helped greatly to make known to the public the *facts* about them. In the light of her intuitive methods, it can be doubted whether many of her statements can be accepted as *facts*. Once when I asked a herpetologist whether her notes would be published, he replied that he really did not know, for whoever tackled the job of editing them must exercise extreme care to separate the chaff from the wheat, for not to do so would be putting at stake one's own scientific standing.

Then, too, it is dubious whether her techniques have accomplished much as far as persuading people to overcome their prejudices. She may, indeed, have shown that snakes can be induced to part with their normal fears — scarcely a novel observation. But the fact that she was repeatedly bitten and finally succumbed from a bite (with each incident rather widely publicized) makes it difficult to state flatly that she influenced many individuals to rid themselves of their prejudices.

In defending poisonous snakes, it must be admitted that she did not imply that just anyone could — or should — handle them as she did. She wrote that they have different ways of showing their moods, but to be able to "*see* and *read* these signs," one must "*know*" these animals well. (Italics hers.) "When they are nervous or excited, no one should work with wild, poisonous, or otherwise dangerous creatures."

By coaxing an occasional aspiring herpetologist to take dangerously poisonous snakes in his unprotected hands, she ran the risk of his eventually being bitten. Publicity of that sort is apt to make the public all the more antagonistic toward snakes in general, since it tends to group them all together. Most naturalists champion only the harmless kind and, by differentiating between the nonvenomous and venomous, lessen the belief held by so many that "all" snakes are to be shunned or killed at sight.

In evaluating Mrs. Wiley's work as a herpetologist, one must call attention to two factors that seem to dominate her life—one, a sincere desire to be recognized as a scientist, the other, a passion for attention and publicity. We do not conceive of a genuine scientist as having at his elbow a press agent. Rather, we picture him in the obscurity of his laboratory patiently and painstakingly arriving at facts and conclusions from his observations and experiments. Mrs. Wiley's attempt to travel two paths simultaneously resulted at times in incongruous situations.

As an example, after serving as Curator of the Museum of Natural History, Minneapolis Public Library, she became Curator of Reptiles at the Brookfield Zoo, near Chicago. While at the latter place, a controversy occurred between her and a superior over a local newspaper story about the reptiles at the zoo. The official charged that she had not received permission for the reporter to interview her. She countered that she had. In his remonstrances, he compared the kind of publicity given the institution in this instance to the ballyhoo for a "fan dancer." One does not need the Brookfield side of the story to realize that a parting of the ways was inevitable. Pathetically, though, Mrs. Wiley felt so embittered that she preferred that I omit any mention of her ever having been at the Brookfield Zoo in depicting her career.

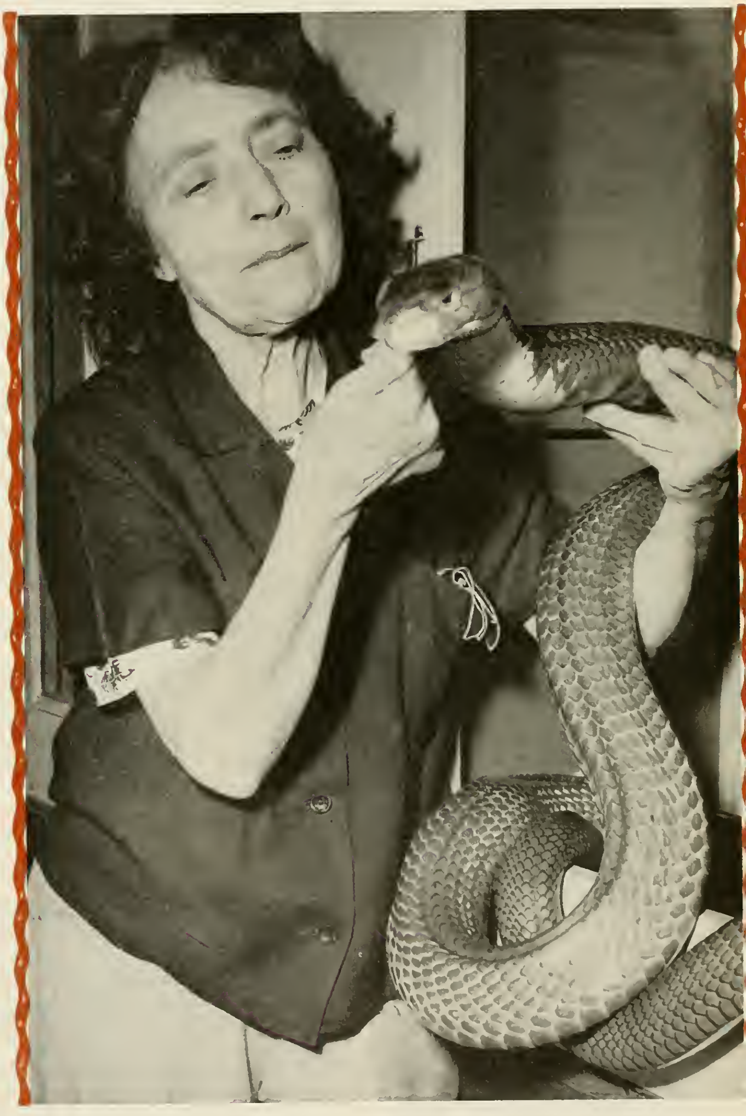
On the other hand, her yearnings to be accepted as a scientist caused her on occasion to resent the type of publicity she received. A good illustration of this took place following her severance with the Brookfield Zoo. In 1936, she came to California, where she rented her snakes to motion-picture studios. Although generally pleased with the many articles that appeared about her animals, one aroused her deep indignation. The writer, a well-known Hollywood public relations man, evidently assumed that anything to make the story exciting was permissible, for his piece gave the impression that her most poisonous snakes crawled at random throughout the building in which she housed them. Over the phone she protested to him that they all resided in tidy pens and that her project was not in the nature of a carnival but educational and scientific. He apologized but said nothing could be done about it.

In fact, it grieved her that some of our outstanding herpetologists failed to approve of what she was doing. She lamented to my wife and me that, despite her long stay in California, a certain curator of a reptile house at a zoo in this state steadfastly refused to visit her place.

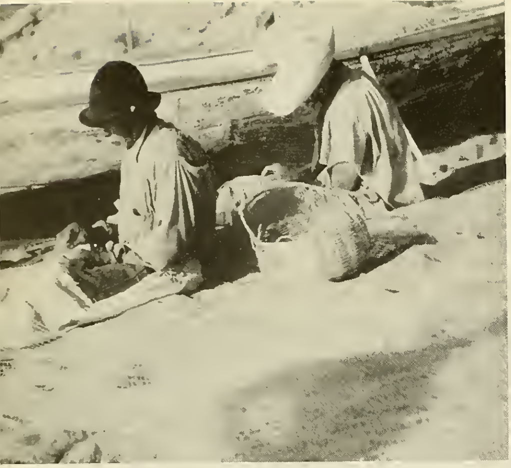
In reviewing her career, other details should be made known. So zealously was she interested in the welfare of her captives that she often went without food to feed them. She once exclaimed to my wife and me that she would not hesitate to sleep in the cage with her favorite cobra, King. She was affable and invariably courteous. She believed, however, that at times others took advantage of her goodwill. To cite a case, she felt that the studios did not always pay her a just fee for the services of her animals. She was an ardent woman suffragist.

I was also informed that she was acutely nearsighted. When my wife and I visited her home, she requested that I read aloud my notes about her instead of having her look them over herself. When she read to us the beginning of her autobiography, she used a large magnifying glass. My informant revealed that she felt that she took a better picture without glasses and accordingly posed for photographers without them when she handled her venomous snakes. He believes that if she had been wearing her glasses, she would have been more aware of the actions of the last cobra she handled and would have escaped its fatal bite.

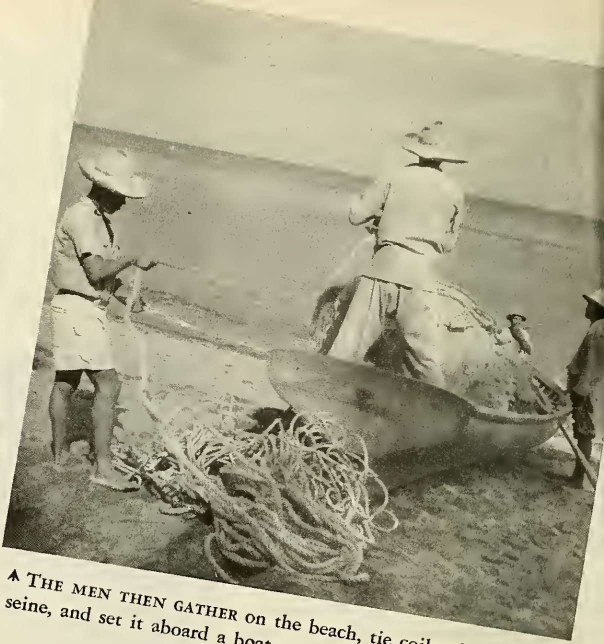
Paradoxically, it appears that history will acknowledge Mrs. Wiley not as a scientific herpetologist, as she sincerely believed she was, but as a showman — the very thing she decried. As an entertainer with reptiles, herpetologists have no quarrel with her. At the same time, they candidly point out that snake "charmers," religious snake handlers of Tennessee, and similar exhibitionists provide a fertile field for psychologists. Because of the wide publicity given her claim that she "tamed" poisonous snakes, it is imperative that a warning be given the unwary who might be so foolish as to be tempted to follow her example. With her insistence that her conclusions were scientific, it is proper that they be scrutinized under the searchlight of science. For these reasons this humble appraisal has been made.



▲ INDUCING KING TO POSE. His length was said to be 15 feet, and he had never had his fangs pulled



▲ MUCH OF THE FISHERMEN'S TIME is spent making and repairing equipment, but this work is dropped whenever a school of fish is sighted



▲ THE MEN THEN GATHER on the beach, tie coils of rope to the seine, and set it aboard a boat

Caribbean Fisherfolk make a haul

On the picturesque isle of Terre de Bas, seining is a community affair, and the aged and needy are among the first to receive a share

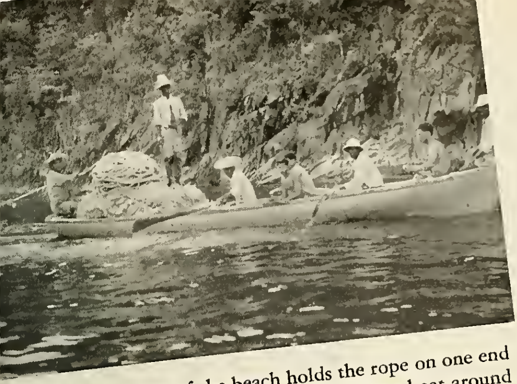
By KINGSLEY NOBLE

Northwestern University

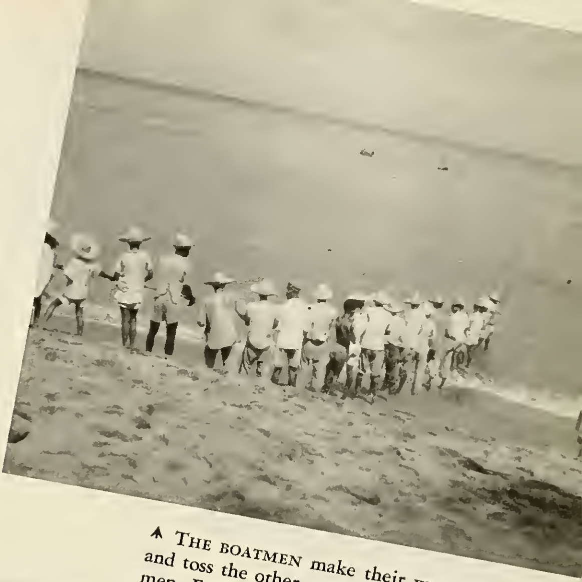
ALMOST due south of the capital of the island of Guadeloupe in the West Indies lies a cluster of islands called Les Saintes. On one of them, Terre de Haut, there is a splendid harbor and by its side a picturesque fishing village, whose facilities, including a small hotel, attract numerous visitors from Guadeloupe. Many of the inhabitants of Terre de Haut are native-born whites whose ancestors came from the maritime provinces of France. Visitors to the island have sometimes felt they were in a tropical counterpart of a French fishing village, yet the people speak a patois or French dialect, whose grammar has several characteristics found in the West African languages of the slaves.

The other large island in the cluster, Terre de Bas, is only three miles away by sail boat, but few outsiders visit it. For about ten weeks, as a student of anthropology I had the pleasure of living among the people of Petites Anses ("Little Bays" or "Little Bights"), the chief settlement on this island. Almost all of the inhabitants are colored to some degree, and they put less emphasis on personal independence than their neighbors. They are sociable and co-operative among themselves. They gather enthusiastically to watch their home team play soccer with semi-pros from Guadeloupe; and in the economic activity of seining, which is depicted in the accompanying photographs, they pool their energies and divide the catch.

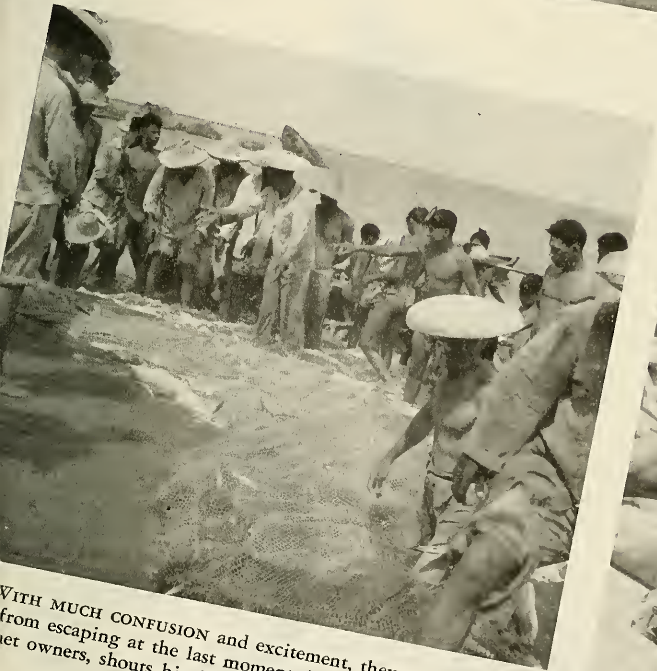
When a school of fish has been sighted in one of the bights, men, boys, and even young girls come to the beach to help with the haul. With any luck, everyone benefits. The catch is first divided so each helper receives enough fish for a meal. The aged and needy take advantage of this hand-out and hobble down to receive a share as charity. The remaining fish are sold and the proceeds divided. Half goes to the owners of the equipment, and half is split equally among the workers.



A GROUP at one end of the beach holds the rope on one end the seine while the best oarsmen row the long boat around e school of fish, paying out the net as they go



▲ THE BOATMEN make their way across the bigh and toss the other rope to a second group of fisher men. Everybody then pulls the net slowly towarc the shore

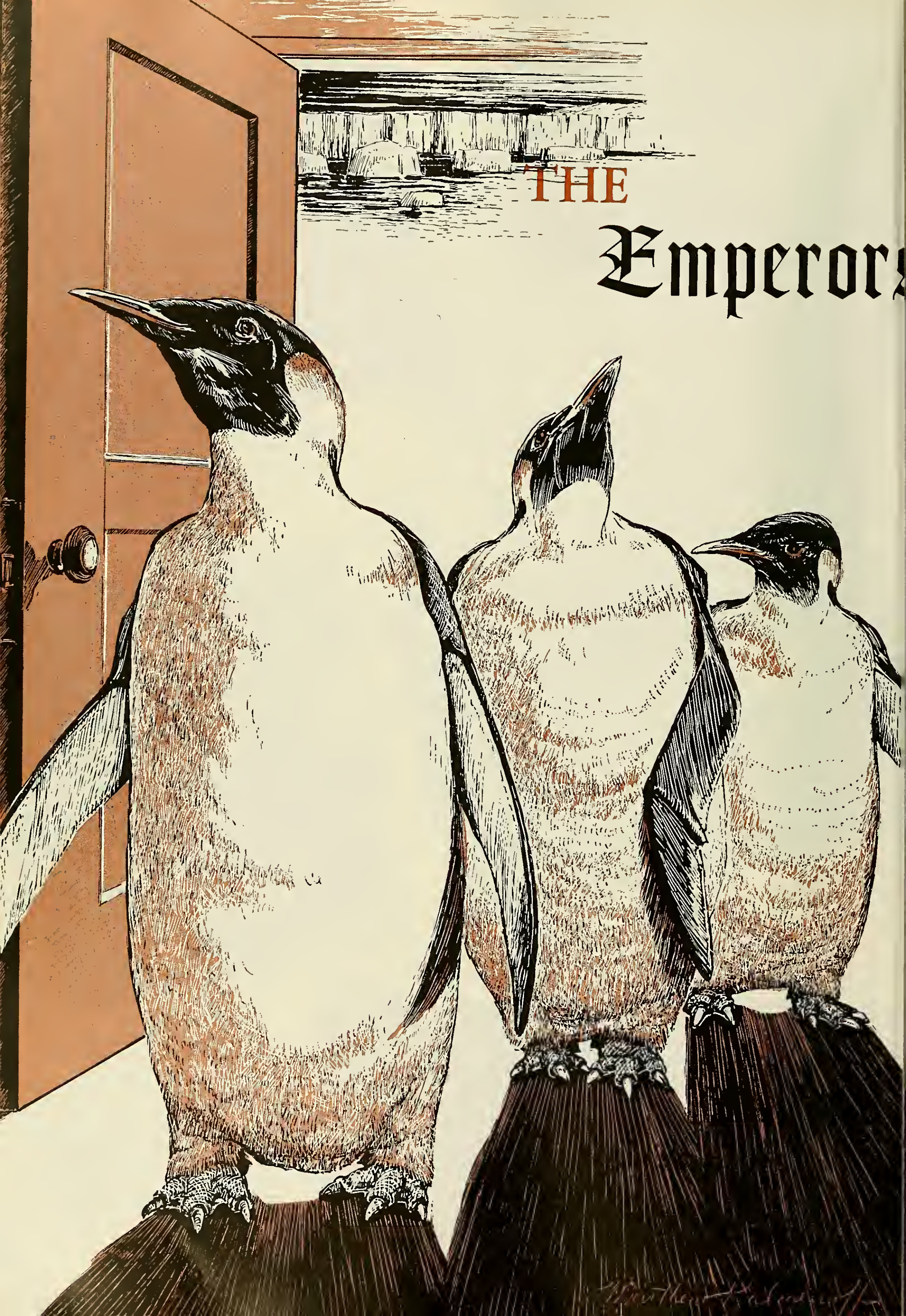


WITH MUCH CONFUSION and excitement, they try to keep the from escaping at the last moment. The leader, who is one of et owners, shouts his directions above the clamor

▲ TWO BOYS string together the fish they have received as their preliminary share of the catch

◀ THE REMAINDER of the catch is loaded into an open boat and sailed to market. Before the fishermen can return home, they must pull the boats high on the beach and lay the nets out to dry

THE
Emperor



Like the man in the well-known play, they stayed a year. They shed their "frock coats" and endeared themselves to their host—the only person who has ever entertained the world's largest penguins for so long

VHO CAME TO DINNER

By H. W. REYNOLDS

As told to N. PELHAM WRIGHT

Drawing by Matthew Kalmenoff

I LIVE on the coast of Tierra del Fuego, near the southern end of South America. Specialists often travel to distant places to study strange animals, but I have had one of the world's strangest creatures swim nearly 1000 miles from where it was born to land on my doorstep. The animal was the Emperor Penguin, one of the least-known and most interesting birds—and one of the largest. No less than three of these magnificent creatures have arrived from the Antarctic as uninvited guests on our seaside farm. One of them was more than four feet tall.

So far as I can find out, no one else has been able to study this curious, flightless bird for any length of time in captivity or as a pet. I made myself personally responsible for looking after two of our visitors. We accepted them as frock-coated ambassadors from another world and learned to love them—but that is getting ahead of the story.

This largest of the penguins normally breeds only on the ice surrounding the Antarctic Continent and rarely travels farther north than the West Antarctic Archipelago. I know of only five Emperor Penguins that have been encountered away from Antarctica—four on the shores of Tierra del Fuego and one on Kerguelen Island, in the South Indian Ocean, about 1200 miles away from Antarctica.

After their long swim, our birds seemed very tired. They moved about very little to begin with, as though recovering from an ordeal. I believe that abnormal weather conditions may have been responsible for their journey. They came in early winter (May or June), after a period of storms. They doubtless crossed much of the distance on northbound ice floes, but these floes would have broken up far from our shores and the birds must have had a very long swim.

The Emperor is easily the largest kind of penguin. Ours were imposing birds; one of them, as I say, measured over four feet in height when standing quite upright with the neck extended. The heaviest one weighed almost 62 pounds.* They were all young birds, for they obtained their first adult plumage while they were with us, and we could never know whether they were fully grown or not. Both of the birds I looked after lived with us for a whole year, so I had plenty of time to get to know them well. Both were extraordinarily tame, though they would not allow anyone except my mother and me to do absolutely as we wished with them.

What seemed to be most extraordinary for a swimming bird was that these penguins evidently had a dread of the sea, possibly the result of their long voyage. Once or twice we took the first bird down to the beach in a wheelbarrow to see whether he wanted a bath or would swim, but he always fled from the water as fast as he could, as though frightened of it. It has been suggested that he may have been afraid of sea leopards—spotted Antarctic seals. We therefore gave up all attempts to give the penguin a sea bath and instead built a small cement swimming pool for it in the garden. When this was filled with fresh water, he thoroughly enjoyed it, but he would never enter it if he knew he was being watched.

One of the most remarkable things about the Emperor is that both the male and female have a fold of skin between the legs in which the egg is carried about. Without this, no Emperor chicks could hatch, because the egg is incubated entirely on the ice, and it would freeze shortly if it were left in contact with it. When mature, the Emperor has a yellow patch on the side of the head, which reminds you of the coloring of the much smaller King Penguin. But in other particulars the two are very different.

Another thing that surprised us was that none of these birds would touch fish. Squids probably form a large part of the bird's normal diet. We fed them on raw meat, necessarily by hand. These birds apparently cannot eat from the ground, and we had to put each piece of meat into their beaks. If we ever put in a piece of fish instead, the bird would reject it vigorously, showing every sign of intense annoyance.

The first bird landed on a near-by

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* One Emperor Penguin is known to have weighed 94 pounds, and the average is around 70 pounds.—ED.

beach and was brought to us in a car. It spent most of its time in the chicken-run, but I would quite often take it out for walks. It seemed to enjoy this and followed me slowly, rolling along like a seaman. (Penguins on the ice are known to drop to their breast and toboggan rapidly along, using their powerful legs and wings at nine or ten miles an hour.) The second bird had the complete freedom of our large front garden —and, incidentally, never trod on the plants! This one learned very quickly to open even difficult gates by watching how we did it. It used to let itself out and go for a walk alone when it wanted to, returning always in a very dignified manner when it wanted something to eat.

Proof that it learned to open gates from our example is furnished by the fact that, when it wanted to come into the house for company, it once or twice succeeded in turning the heavy round knob on the front door with its beak. Unless it had watched and understood our actions on entering the house, the bird could hardly have known that this was the way to open the door. I stress this because it seems that ornithologists are divided in their opinions as to whether the Emperor possesses much mental capacity. I think this gate- and door-opening business proves that the bird can observe an operation quite foreign to its normal life and, with only a beak in place of a hand, imitate the action to attain a desired objective.

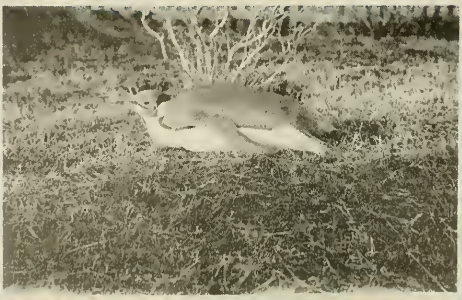
On the other hand, Emperor Penguins sometimes behave in such a manner that one might suppose them governed only by blind instinct or unreasoning emotion. Dr. Robert Cushman Murphy points out that during the brooding season the desire to mother something is so strong that eggs formerly frozen and long addled, as well as dead chicks and lumps of ice, are tucked onto the feet and covered with the feathery muffs of would-be fathers and mothers. "So avid and blind, indeed, is the interest of parents and foster parents alike in eggs and chicks that the resulting struggles work entirely gratuitous hardship upon the offspring, many of which are literally killed by kindness. No sooner does a brooding bird indicate its readiness to give up its charge than a scrimmage takes place, with dozens of free adults competing savagely for the honor of the next turn. As a result, the young are very roughly handled, their skin is frequently torn, and sometimes they become lost altogether by dropping into a crevice, in which they freeze to death while the old birds are completing a pointless argument above them." Even this dismal scene does not convince me that Emperor Penguins are not capable of learning from observation, and I might point out that parental quarrels of a similar nature are observed even in the highly intellectual human family.

The birds would always "answer me" when spoken to, and we used to carry on spirited conversations from opposite ends of the garden. In the end, they would always come to me. As far as I could make out, they made three distinct noises, each with a special significance. When they were pleased with themselves, they would utter one of these sounds. A second call seemed to denote surprise or astonishment. And the third was a sign of annoyance or anger. I learned to imitate these three noises reasonably accurately.

After about six months, the birds underwent a complete molt. In this, they shed not only the feathers but also the skin, including that of the legs and feet and the sheath of the beak. The plumage that came afterward was resplendent and quite obviously their first adult attire, which proved to us that they were all young birds. The annual molt is evidently a major problem for the Emperor. The birds fasted for an entire month. During this time they stood erect on almost the same spot and lost a lot of weight. To my certain knowledge, one of them did

Continued on page 430

THE AMBASSADORS from Antarctica molted and became resplendent. In the posture shown below, Emperor Penguins make nine or ten miles an hour on ice



◄ EPHRAIM TAYLOR, putting the finishing touches on a modern replica of one of the pipes that have made the region famous. He is applying heated beeswax with a cloth to give the pipe a lustrous sheen, which it will retain indefinitely

The REDMAN'S *Garden of Eden*

A National Monument dedicated to peace commemorates the spot where the Indians secured the red pipestone for their ceremonial pipes—a region rich in historic lore

By ARTHUR L. CENTER

All photographs by the author

FROM atop the quartzite ledge, we overlooked a panoramic view of Pipestone National Monument, with its blood-colored crags, small glacial lakes, virgin prairie, and small wooded area. The place: southwestern Minnesota; the time: 1950. Yet the present faded under the weight of legends that bind this region to another era and another culture. For this was the scene of the Sioux Indians' version of the creation of man. This was the birthplace of the American ceremonial pipes—and the only Monument in the United States dedicated entirely to peace.

Mr. Lyle Linch, Superintendent of Pipestone National Monument, directed our gaze over the wind polished ledge to what looked like two large fossilized bird talons in the rock. We were gazing at the footprints of the Great Spirit of the North American Indian. Here, according to Indian lore, the mighty God stood in the form of a huge crow and molded the Redman from a piece of pipestone. The Indians, Mr. Linch informed us, believed the rock got its streaky red coloring from the trickling blood of slain bison, which the Great Spirit devoured for nourishment.

So this region was doubly sacred to the primitive Indians. It was the place of their origin and the only locality they knew of where the peculiar red stone could be found. According to ancient legend, a Yankton squaw accidentally discovered the red pipestone while pursuing a white bison along the banks of Pipestone Creek. When the bison scraped the topsoil with its hoof, she saw the indurated red clay. From this soft clay stone came the ceremonial pipes. The pipes were originally used in a variety of rites, including those for war. But in more recent times they have been idealized as a symbol of peace.

Quarrying the pipestone was a very solemn ritual to the Indians. The Great Spirit, legend claims, assembled the Indians to announce that the rock itself was their congealed blood. Before the Indians would dare touch the stone, they spent days in ceremonial dances and prayers at the quarry. Then, if the medicine man said the signs from the sky were favorable, the braves would remove the overlying soil and quarry the pipestone, while their women and children looked on in reverence. After enough of the pipestone slabs had been broken off and laid out in the sun to dry, the diggings were covered over with the removed topsoil. This was done to "stop the bleeding" and "heal the wound." During the winter months the stones were divided among the tribal families, and pipes were carved.

Before visiting this hallowed region, it became a custom for all Indians to bury their war hatchets and observe absolute peace, for they revered this land so strongly that all men were immune from attack while here. Even the lives of paleface trespassers were spared as long as they remained around the quarries, although they were never permitted to observe the operation of removing the sacred rock. History, it is interesting to note, does not record any bloody battles in this region between Indian tribes or with the United States Army — no massacre of white settlers or the burning of wagon trains on the Coteau des Prairies. The closest massacre occurred over 30 miles away, at Lake Shetek in 1862.

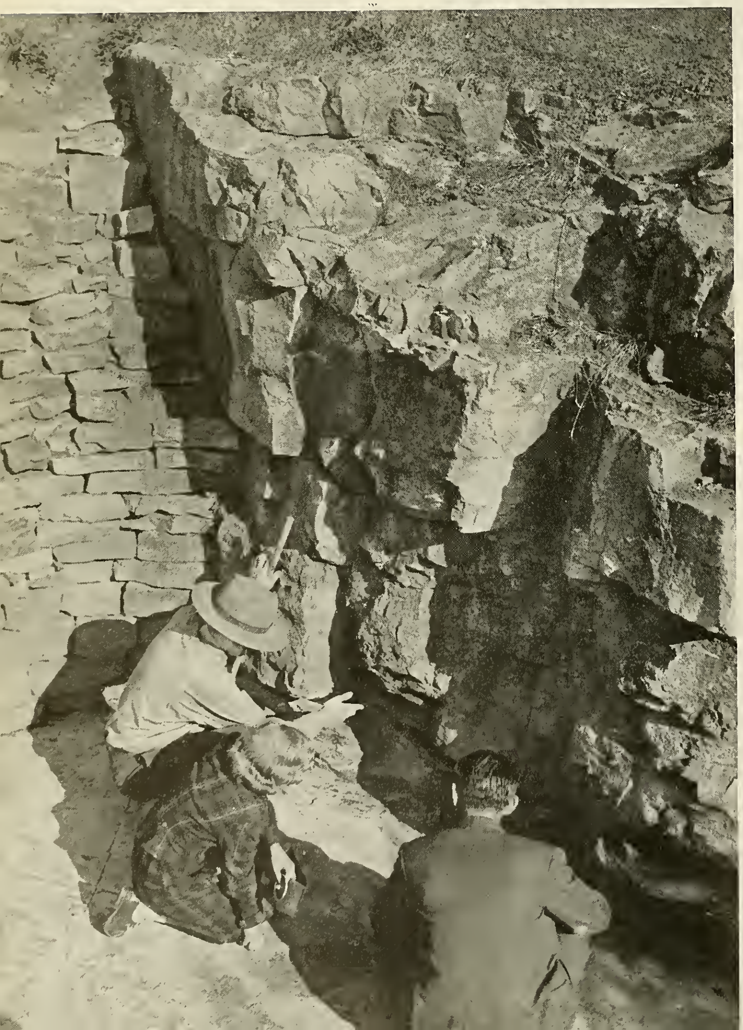
At the northern end of the area, Mr. Linch pointed out a stone monument erected near the graves of a Yankton, an Omaha, and a Chippewa who tradition says were buried side by side. "These blood enemies," he said, "now resting together in lasting peace, symbolize the eternal truce for which this place stands, so we call this our peace monument."

It was this strict observance of peace that prompted the local townspeople to call the place the Pipestone Indian Shrine long before it was officially named the Pipestone National Monument. There are still many citizens in Pipestone who would like to see the Government reinstate the former name, which they believe is more fitting.

Long before the white explorers and adventurers wrote about the Indian ceremonies, the Redman kept his own records. Several huge quartzite slabs have been found with numerous petroglyphs, etched perhaps with a piece of flint or some blunt instrument, in patterns that suggest a legend or event. Recognizable pictures of animals that frequented the plains are found beside human forms and sacred symbols of worship. Some of the best preserved of these petroglyphs were removed a few years ago to the basement of the Pipestone Public Library for safe-keeping. Here the public may inspect them on request.

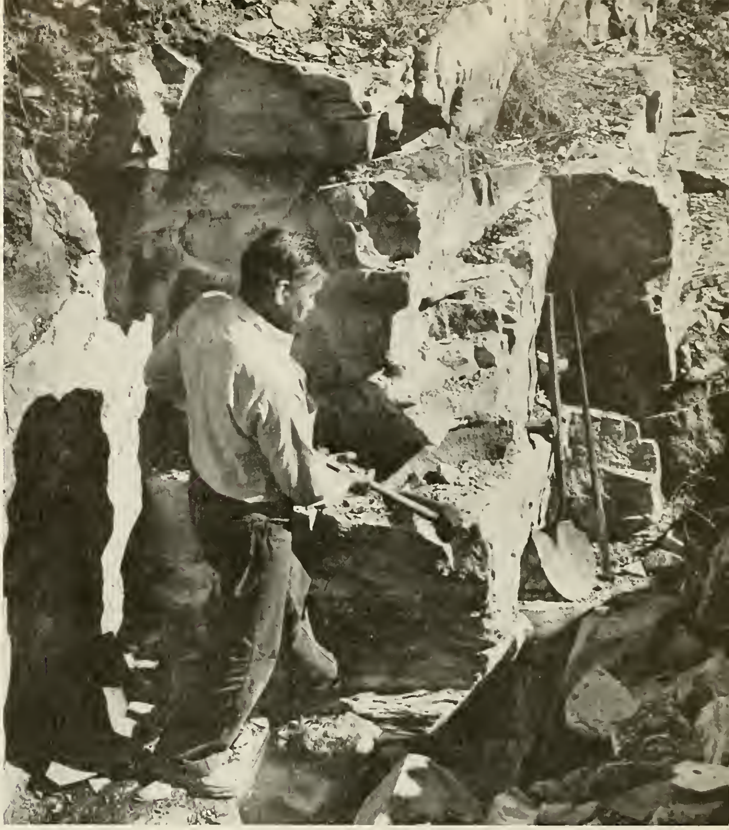
The white man's first adequately recorded visit to this spot was mentioned in the books of the artist George Catlin. Accompanied by an Englishman named Wood, he saw the quarries in 1836. Although others had visited the sacred grounds years before his arrival, the stone was named "catlinite" in honor of the first man to relate his findings in a book. Mr. Catlin also published several fascinating classic legends, which are still told today by the local Indians.

Two years after Catlin's visit, the region was entered by six explorers

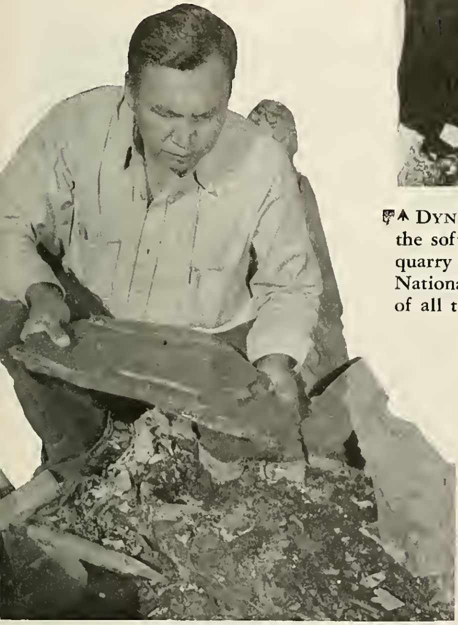


◄ THE WORLD'S ONLY EXHIBIT of pipestone in its natural position. Lyle Linch, Superintendent of Pipestone National Monument, is showing visitors how the pipestone, or catlinite, is found in layers between massive layers of quartzite led by Joseph Nicollet, who had been hired by the Secretary of War to make a geographic and geologic report of the upper Mississippi and Missouri Basins. Like the aborigines, these men left a record of their visit in stone by carving their names on a flat crag near the waterfall. Today a plaque has been placed next to the signatures commemorating this event, and the historic quartzite rock is protected by an iron railing.

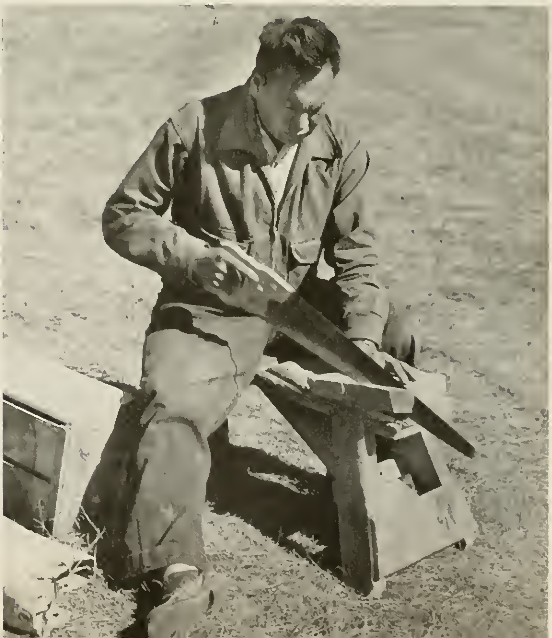
There were others who toured the area when westward expansion tamed and popularized this wilderness. Artists, authors, and poets immortalized the factual and legendary history of the land of the pipestone quarries. No doubt the most



▲ DYNAMITE would shatter the pipestone, so Ephraim Taylor must remove the soft, velvety stone with a sledge hammer and chisel. He operates the quarry under a Special Use Permit as provided by the Act establishing the National Monument. Quarrying of the red pipestone is reserved to Indians of all tribes under regulations prescribed by the Secretary of the Interior



▲ A NICE THICK SLAB of pipestone to be carved into a peace pipe



➤ THE FIRST STEP in making a pipe the modern way is to cut an appropriately shaped piece of pipestone with an ordinary wood saw famous and best-remembered piece of work in honor of this place is in *The Song of Hiawatha* by Henry Wadsworth Longfellow. Remember the opening lines of the "Peace Pipe Poem"?

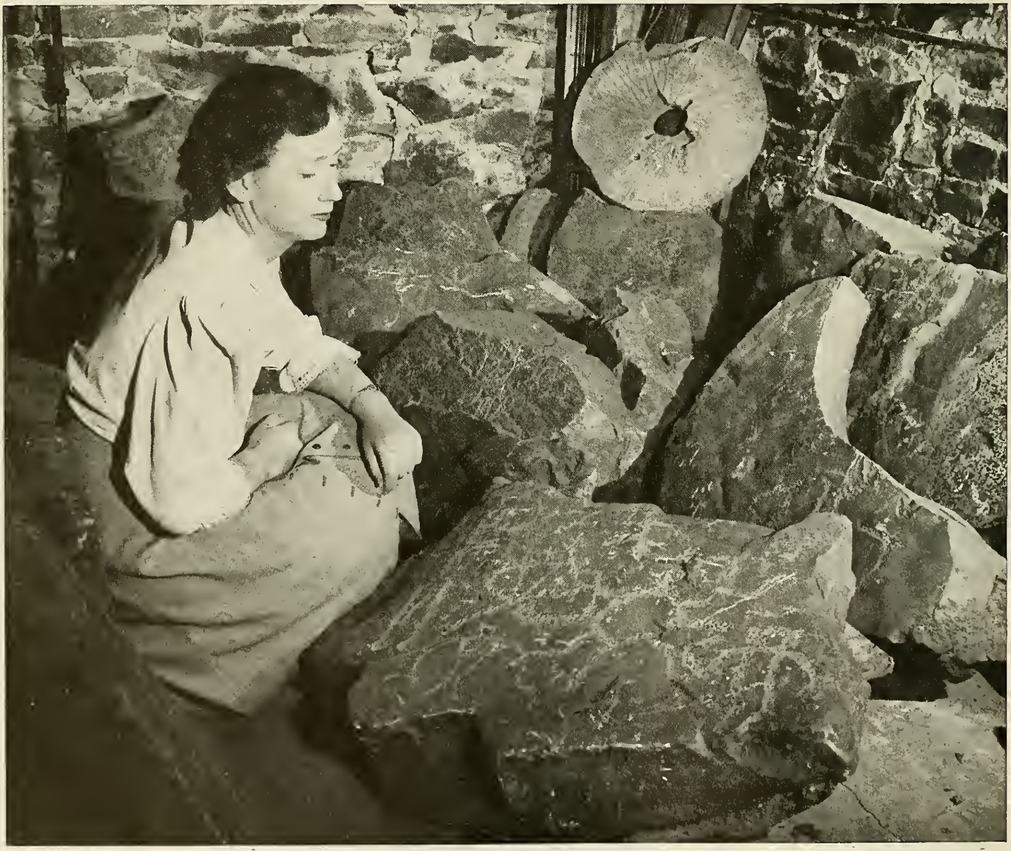
> On the Mountains of the Prairie,
> On the great Red Pipestone Quarry,
> Gitchie Manito*, the mighty,
> He the Master of Life, descending
> On the red crags of the quarry,
> Stood erect and called the nations,
> Called the tribes of men together.

Scarcely a spot of equal size in the United States can boast of more legendary history than Pipestone. According to Mr. Linch, there are at least 30 legends, half of which have never found their way into print. The other half remain with the Indians who still inhabit the region in great numbers. Outsiders, to hear these tales, must first obtain the friendship and trust of these Indians.

Mr. Linch is one outsider who seems to have gained some of this confidence, and the stories he narrates on his conducted tours create an aura of mysterious enchantment, missed by those who take the well-marked trail alone and uninformed. There is the story of the jealous maiden whose tears created Winnewissa Falls. And there's the story of Leaping Rock, where young warriors performed daring feats of broad jumping. Here they attempted to span the eleven feet from a quartzite ledge to the top of the narrow, highly polished Leaping Rock – a dominant geological feature in the Monument area. To the successful man there was honor and respect from the tribal warriors; to one who failed there was death, or a body mangled by a 22-foot fall on the hard rock below.

From the claw prints of the Great Spirit, where one tour makes its first stop, you walk past the natural stone face of the "Oracle," or "Chief Head," and cross the bridge to the top of Winnewissa Falls. After a study of Leaping Rock, you pause to read the Nicollet signatures near by. From here the trail leads through a field of beautiful wild flowers across Lake Hiawatha to the only *in situ* exhibit of pipestone in the world.

▼ INDIAN PETROGLYPHS from the pipestone quarries are exhibited to visitors by Miss Marycay Earhart in the basement of the Pipestone Library. They have been placed here for protection against vandalism



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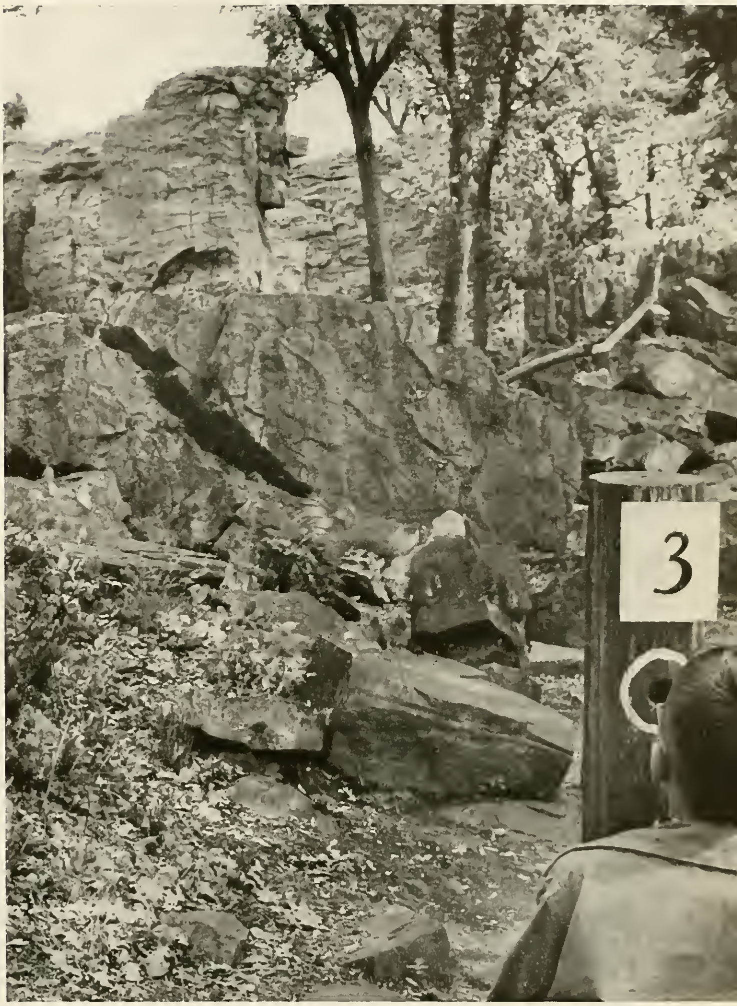
* Longfellow erred in placing this deity in the theology of these particular Indians, but the idea is consistent with their spiritual philosophy.—ED.

⮟ A GREAT STONE FACE is easily seen on Leaping Rock through a hole in a post placed for the convenience of visitors along the numbered trail



Beneath the legends accounting for these strange things, there exists, of course, a scientific explanation. The pipestone, for example, is colored by a varying per cent of iron oxide instead of by the congealed blood of a bison. And the huge boulders at the south end of the Monument near the entrance gate were carried there during the great Ice Age; only in legend are they the spirits of three Indian maidens who sought refuge there during a violent electric storm. On close inspection of the lower south side of these rocks, one can see a fine example of glacial stria, or grooves, caused when boulders embedded in the ice scraped over a quartzite slab.

When the tour is over, you can watch the Indians fashioning trinkets out of pipestone. A "Special Use Permit" allows only the Redman to work the quarries and fashion the stone into trinkets. Today, two Indians quarry the stone, each operating his own mine; and unlike their forefathers, they do not stand on ceremony. The pipestone is now 10 to 15 feet below the surface. As the use of dynamite would shatter it, these two men, each operating his own mine, remove the soft, velvety stone with a sledge hammer and chisel. It is a slow and tedious job uncovering the valuable layer, so the quarries are no longer covered over after the pipestone is broken off.

A visit to the Monument is scarcely complete until one has stopped in Mrs. Roe's Trading Post in Pipestone and looked over her Indian relics. This large collection contains many pipestone calumets, as the ceremonial pipes are called, that were smoked in historic war councils, peace talks, and land exchanges between the prairie Indians and the white man.

Most of the pipes, which took Mrs. Roe and her late husband almost half a century to accumulate, were removed from Indian burial mounds or uncovered by local farmers during spring plowings. A few of them were presented to her by neighboring Indian friends, who as children witnessed quarrying operations.

Her pipe collection, like the pipestone quarries, the peace shrine, and the claw prints, contributes its share to the rich lore of the region. And all of the things bring the visitor closer to a primitive world where treaties and ceremonies were conducted under the stars, and the untamed prairie was the Redman's happy hunting grounds.

BOOKS

Continued from page 391

his book is filled with material of interest to the naturalist with scientific leanings. The student of nature who is seeking simply a source of identification will find this book the best that has ever appeared, and he may find his interest drawn to the exciting problems of butterfly biology, which lie beyond the philatelist-like approach to butterfly collecting. The elaborative chapters, on such subjects as "Some Principles of Classification" and "The Butterfly and its Environment," are well segregated, so that the reader may take or leave as much as he pleases.

For each species the *distinguishing* characteristics are discussed fully, often by means of keys. The preferred environment, habits, and flight periods are usually mentioned. Considerable space is devoted to larvae and food plants, but much of it is wasted, since the larval descriptions are frequently old and unchecked and almost none are comparative.

Nearly every species has been illustrated by photographs or by colored paintings. The illustrations are of uneven quality, some being excellent but several poor. Nevertheless, the present plates will suffice for making identifications.

Some nature study enthusiasts will welcome Dr. Klots's use of "common" names for a large proportion of butterflies. Personally, I deplore the practice of concocting common names for rare or obscure species and believe that any collector experienced enough to deal with such species can also use scientific names.

These are relatively minor errors and matters of judgment. There can be no doubt that this is the best book on North American butterflies in the present century.

C. L. Remington

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DICTIONARY OF THE ARTS—by Martin L. Wolf, Philosophical Library, $10.00, 797 pp. — Definitions of words in the fields of painting, sculpture, music, theatre, the dance, literature, architecture, archaeology, mythology, ceramics, costume, and applied arts.

THE MOLDS AND MAN—by Clyde M. Christensen, Univ. of Minnesota Press, $4.00, 244 pp., 7 figs. — Basic facts about fungi—how they live, reproduce, and affect other plants and animals, including man. Readable and authoritative. Dr. Christensen is a mycologist in the Dept. of Plant Pathology at the Univ. of Minnesota.

THE DUSKY-FOOTED WOOD RAT—by Jean M. Linsdale and Lloyd P. Tevis, Jr., Univ. of Calif. Press, $7.50, 664 pp., 384 figs. — An intensive, sociological account of the wood rat, based on the histories of 580 individuals at the Hastings Natural History Reservation.

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THE EMPERORS WHO CAME TO DINNER

Continued from page 424

not move outside an area of two square yards. They were obviously very uncomfortable during their molt. When the new coat, which had formed underneath the old skin, began pushing the latter outward and breaking it up, the birds would help the process by pushing the old skin away with their beaks. My mother used to help them, and they obviously liked to have her do this. But if we tried to take off a piece that wasn't ready, it evidently hurt them and they would gently peck us for our pains and treat us to the "annoyance noise." When they apparently felt that their transformation was complete, they let themselves go and, repeatedly uttering their "pleasure sound," left their two square yards of "isolation ward" and came up to the house to break their month's fast.

I became so much attached to these birds—and I really believe they felt some sort of affection for me—that when they eventually died (in each case of a parasitic ailment), I felt a very deep sense of loss. As you can imagine, I often look rather wistfully along the beaches in the early winter, hoping that we may have yet another portly black-and-white visitor from Antarctica. The affection one can feel for a favorite dog was in this case enhanced, in a sense, by the fact that these creatures had come from another world, where men were unknown to them and where there had been no background of domestication. I often wonder what effect a few generations of domestication would have on the Emperor Penguin and what height of attachment or intelligence the bird could attain through continuous and intimate association with man.

Continued from page 385

Emil Liers photo

▲ A CRAYFISH eating a bass fingerling. In this way, the fisherman is sometimes frustrated by the crayfish. Otters, though they are often blamed for the damage, will actually hold the crayfish population down and preserve a better balance for the angler

for his own use and that of his immediate family."

4. **Why can't the bald eagle be protected instead of a bounty being paid on it?**

The Secretary of Interior could give the bald eagle legal protection if he wished. At present the bald eagle, along with the golden eagle, with which it is frequently confused by Alaskans, is left unprotected along with all the other members of the hawk and owl group. Under the provisions of Section 46.151 it is provided that there shall be no closed season on crows, hawks, owls, eagles, ravens, magpies, and cormorants, and their nests and eggs, except in a national park, monument, or posted national forest area.

The bounty on the bald eagle is paid by the Territory of Alaska under a law enacted by the Territorial Legislature for reasons that are not at all clear except that the role of predatory forms of wildlife is not as a rule very well understood in pioneer communities like Alaska.

5. **Is such an ill-advised policy advocated by the personnel of the agency in question?**

The placing of a bounty on the bald eagle was not advocated by the personnel of the Fish and Wildlife Service, and at least some members of that Service undertook to do what they could to advise against the passage of the Bounty Act. The Secretary of Interior, however, has to date failed to take the steps that he could take to stop the killing of these birds if he was convinced of the correctness of the Fish and Wildlife Service's stand against the bounty.

6. **Are the personnel this agency does have inadequately trained?**

No. The Fish and Wildlife Service have some well-trained men on their Alaska staff. Primarily, what they need is more trained men, especially men trained in ecology. Alaska covers a vast area, and as yet they have a wholly inadequate staff for the job they are supposed to be doing.

7. **If the personnel of this agency are not to blame, who is?**

You and your fellow citizens. You should convince the Secretary of Interior that he would have the whole-hearted backing of the country if he told the Alaskans that he was placing the bald eagle under protection and that any further killing of it for the bounty would be illegal.

8. **What, if anything, are the officers of public and private conservation organizations doing to see to it that the agency involved is provided with sufficient authority, the right number of properly trained men, adequate equipment, and funds?**

The Secretary of Interior submits a budget each year to Congress in which he asks for funds for the work of the Fish and Wildlife Service in Alaska. This is all he can do. To date, the private conservation organizations of the country have not stimulated sufficient interest in the matter to induce Congress to appropriate the needed funds.

9. **Are they depending merely on response to magazine articles—on scattered letters to Senators and Representatives—to carry the field in Alaska; haven't they formulated a definite, ecologically sound policy for which they are actively seeking public support?**

The answer to the first part of this question is yes. Everyone agrees that the Alaskan situation is a bad one, but the country's various conservation organizations are all busy with other programs of long standing and at best are giving only casual attention to the Alaskan situation.

10. **Has a bill embodying a sound, long-range conservation policy for Alaska ever been introduced into Congress?**

The answer to this question should probably be no, as to some extent we lack the basic scientific data for such a policy, and comparatively little is yet being done to obtain that data. There is a bill in Congress, H.R. 1870, that would extend protection to the bald eagle in Alaska through an extension of the law that now protects it in the United States. The basic reason this has not been passed is again that you and your fellow citizens just haven't convinced Congress that you want it passed.

11. **Cannot the leaders of the numerous private conservation organizations at least co-operate to the extent of devising some efficient mechanism for the *organized expression* of public opinion on conservation matters, so that real *pressure* can be brought to bear at the right place at the right time?**

They probably could if someone were to offer to provide the funds that would be needed to finance an adequately staffed co-ordinating office on Alaskan affairs. Such an office could continually point out to the people of the country and to the conservation organizations what they should be doing about Alaska. It should have sufficient funds to publicize its findings and recommendations, and it should have a staff persistent enough to see that their recommendations were eventually put into effect. It would be desirable for this Alaskan conservation affairs office to be in a position to circulate, as spurs to action, urgent items on what is happening in Alaska, based on firsthand research findings of their own men.

CAN WE SAVE THE GRAY WOLF?

Continued from page 396

are signs of concern. Perhaps, some say, the campaigns to destroy him were a bit too vigorous. Perhaps the bill against the wolf contains some unfair particulars. At any rate, quieter, more rational voices are being heard in the Grand Jury room.

One of these belongs to Dr. Olaus J. Murie, retired Federal biologist, and now president of the Wilderness Society. Dr. Murie believes the estimate of 1000 remaining gray wolves indicates danger of extinction. He believes steps should be taken to save this "picturesque element of the wilderness."

Dr. Clarence Cottam, Assistant Director of the U. S. Fish and Wildlife Service, states that wolf control is no longer necessary and adds, "We would hate to see this magnificent animal disappear."

It is almost too late. The wolf is outlawed nearly everywhere except in the National Parks, and the problem is to find him a sanctuary without stirring up cattlemen and sportsmen.

The apparent solution—use of the big National Parks—is virtually ruled out owing to the wolf's vast hunting range. Big as many of the parks are, they are too small to contain wolf migrations. Yellowstone, for example, is surrounded by cattle country. In winter, the Park game migrates down from the mountains and into the surrounding grazing land. Wolves would follow the game, and cattle depredations would probably result. A soon-to-be published study by the Fish and Wildlife Service shows that about one-half of the Yellowstone coyote population moved out of the Park in winter, and only one-half that number returned. One coyote, tagged in the park, was picked up 115 miles away two years later. Wolves migrate farther than coyotes.

Olympic National Park in Washington State would be a more likely wolf sanctuary, except for the protests of sportsmen. There is little cattle raising in the area, but there is game, and hunters argue that wolves would follow the game out of the Park and into their preserves.

The most practical suggestion seems to be that of Dr. A. M. Stebler, of the University of Michigan's laboratory of vertebrate biology. At a recent session of the North American Wildlife Conference in Milwaukee, he suggested Isle Royale National Park in Michigan as a "good possibility."

Isle Royale is a 210-mile stretch of heavily forested wilderness surrounded by the waters of Lake Superior and containing a surplus of game, particularly moose, all protected by law. There may be wolves there today but not in any number. Dr. Stebler suggested that the island offers "an interesting and excellent opportunity to follow through with a study of predator relationships, wherein both relations [prey and predator] are reasonably restricted geographically." He thought Isle Royale offered a natural refuge for the remnants of the Great Lakes' wolf population and the chance to determine what controls on the island's game the presence of a wolf population would offer.

Conrad L. Wirth, Assistant Director of the National Park Service, is inclined to agree with Dr. Stebler. However, Wirth cautions that the introduction of wolves on Isle Royale would have to be on an experimental basis at first. Too many might threaten even an overabundant moose population. But a limited number of wolves would be actually beneficial, since the moose now are so numerous they are eating themselves out of house and home.

In spite of these arguments, there remains some opposition to the introduction of wolves in Isle Royale. Aside from the possibility that they might leave on the ice some severe winter, this island, without wolves, offers a good opportunity to study a game population with no natural controls. There are arguments for and against.

Seemingly, only one more possibility for a wolf sanctuary exists in this country—the Superior Roadless Areas in which both the United States and Canada have an interest. (The Canadian area is called the International Peace Memorial Forest.)

The portion in the United States consists of 1,038,000 acres of wilderness in the northeast corner of Minnesota along the Canadian boundary. It is under the jurisdiction of the U. S. Forest Service. It is natural wolf country, and again there is plenty of game. But under Forest Service policy, the game belongs to the State, not the Federal Government, and Minnesota permits hunting in season. That raises the ancient objection that hunters have against the wolf. There are a few wolves in the area now. Forest Service officials suggest that more wolves be introduced and that they be made game animals, in season, to placate the hunters. The wolves would also serve as a natural balance for a surplus deer population in the remote areas of the wilderness, where hunters seldom go.

In summary, it seems fair to conclude that the gray wolf has an honest claim to existence. No one seriously argues that he is any longer a real threat to livestock or game in this country. He is a traditional and romantic figure in our history; he is one of the few remaining memorials to America's once unspoiled wilderness. Those who love the wilderness should still be allowed to see wildlife, both prey and predator, in natural distribution. The sight of a gray wolf loping through the forest on his ancient quest, or the eerie, thrilling sound of his lonesome howl before daybreak, ought to persuade men that their hearts can still respond gallantly to the call of the wild.

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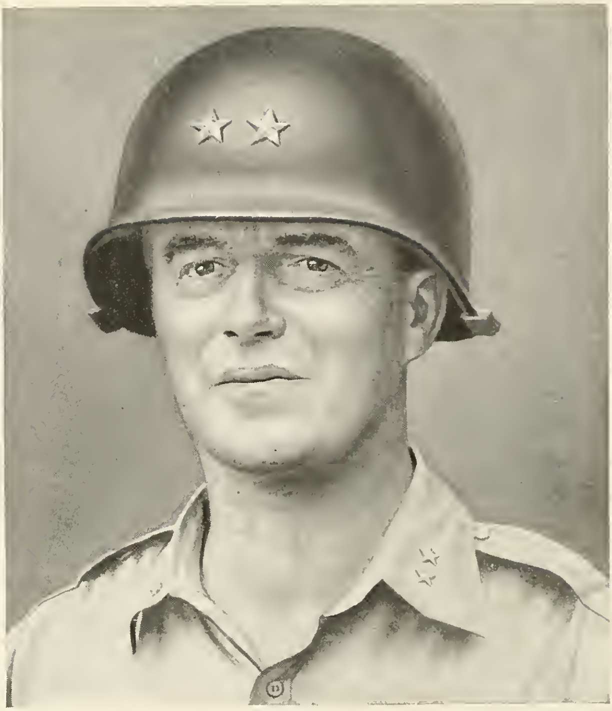

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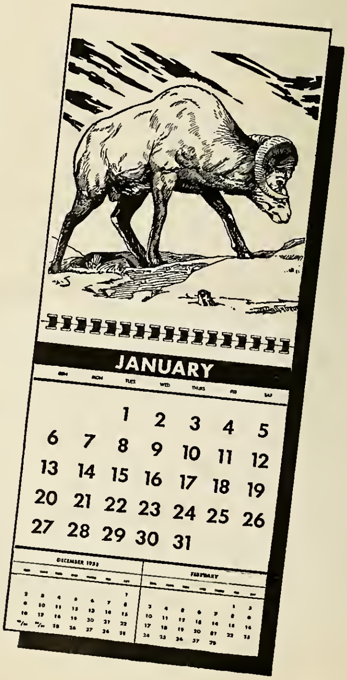

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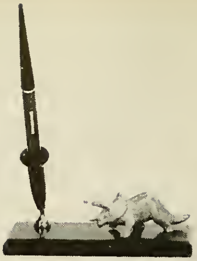

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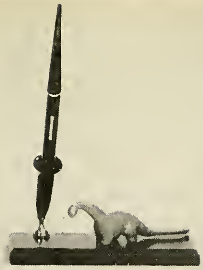

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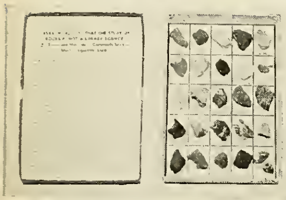

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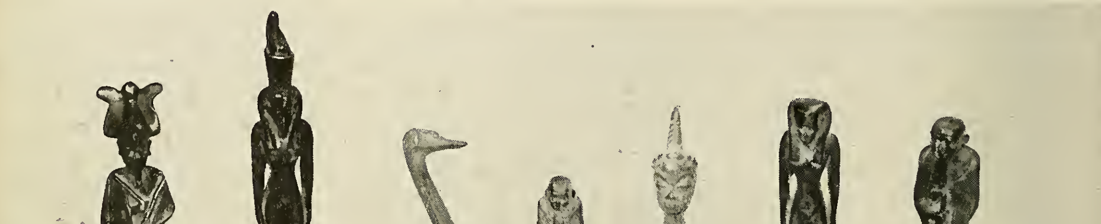

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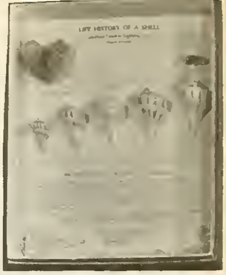
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LETTERS

Forests and Men

SIRS:

In the October issue of NATURAL HISTORY Magazine, we have just read Willard G. Van Name's review of the book *Forests and Men*, by William B. Greeley. In our opinion this review is unfair, inaccurate, and a disservice to the cause of forestry in the United States. Some of the reviewer's statements are so contrary to facts that we feel it necessary to call them to your attention.

First, we would like to comment on the author's claim that political and commercial domination of the Forest Service, the bureau established to manage the National Forests, soon put an end to hopes that the system of government forest reserves would bring profit to the nation and avert a future timber famine. The National Forests as they exist today certaintly refute that claim. To our knowledge, even our severest critics have never made such a charge of political or commercial domination as does Dr. Van Name. We in the Forest Service are extremely proud of its record and challenge any such statements.

The reviewer goes on to say that the Forest Service has not only never shown a profit but that it has been a heavy expense to the nation every year. We wonder if he is familiar with the fact that the National Forests last year returned to the U. S. Treasury several million dollars more than the total of all appropriations for their operation and management. The National Forests, indeed, are now not only paying their own way on a cash basis but are yielding returns in public benefits, such as watershed protection, recreation, wildlife habitat, and other contributions to local and national welfare that are of inestimable value.

Another claim which certainly should be challenged is Dr. Van Name's assertion that the magnificent stands of timber that many of the National Forests used to contain have been entirely made away with. He entirely omits any reference to the fact that on many National Forest areas that were cut-over and burned-over lands, where there was little or no timber at the time of acquisition, regular timber crops are now being grown. He also overlooked the fact that there are still some 44 million acres of virgin timber in the United States, and the bulk of this is within the National Forests. It is true that on much of this area the timber is overmature and deteriorating because of inaccessibility for harvesting. It should be noted, however, that the Forest Service requires that all timber harvesting in the National Forests must be in accordance with sustained-yield principles that provide for continuing forest growth. Within the National Forests also are 14 million acres designated as permanent wilderness, in which no timber cutting is allowed. The total acreage of virgin timber in the United States, incidentally, is about eighteen million acres greater than the total area of all the National Parks put together. This is said without any reflection on the National Parks and their values to the American people.

We wonder just why Dr. Van Name objects to using forests in the United States for the wood products, which only they can provide. Foresters believe that research for finding new uses for wood is one of the best tools for better forestry in this country. New uses for wood help to encourage the growing of timber as a permanent enterprise. Greater utilization means more incentive for sound forestry.

Col. Greeley's claim that regrowth of our forests now nearly equals the drain on them is a true statement of fact when one considers total forest growth. Unfortunately that same claim cannot be made for saw timber, our most valuable type of timber, where according to the most recent surveys the drain is about 50% greater than growth. Col. Greeley makes mention of this condition in his book. Incidentally, that same survey showed that we have ample forest land areas in the United States to meet any foreseeable demands for forest products, provided that land is kept reasonably and continuously productive. So far as can be determined there is no indication that the total area is decreasing to any great extent. The Forest Service is devoting its full efforts to the encouragement of sound and wise management and use of that land in the interest of national welfare.

LYLE F. WATTS, *Chief*
United States Forest Service,
Washington, D. C.

NATURAL HISTORY Magazine is glad to publish this expression of U. S. Forest Service policy. With the drain on saw timber admittedly 50% greater than growth and with our last remaining virgin timber down to 2½% of our total land area, NATURAL HISTORY would like to do something further. We would like to publish photographs, with information as to location and size, of the six finest forests remaining under U. S. Forest Sersive jurisdiction for whose protection the Forest Service needs continued public support.—ED.

SIRS:

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LILLIAN COX ATHEY,
Publisher and Editor.
National Nature News,
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SIRS:

. . . I would like to take this opportunity to express my appreciation of your fine magazine. It is unsurpassed in its field and would compare favorably with almost any magazine printed.

TERENCE W. BELSHAW.
San Antonio, Texas.

Dr. Eugenie Clark Back from Red Sea Expedition

Dr. Eugenie Clark, whose "Field Trip to the South Seas" readers will remember in last January's NATURAL HISTORY, has just returned from Ghardaqa on the Red Sea in Egypt. At an isolated spot on the edge of the desert, the 29-year-old Research Associate of the American Museum's Department of Animal Behavior made the first detailed study of Red Sea fishes in 70 years and assembled the largest collection of these fishes ever made by a single person. Dr. Clark was a Fulbright Research Scholar at the Marine Biological Station of Fouad University.

She will write of her work on this expedition in a coming issue of NATURAL HISTORY.

Key Deer Bill Deferred

The bill to provide a much needed refuge for the Key Deer (H.R. 2897) is still in Committee because of certain local objections. The special protection that the deer have enjoyed this year, thanks to the Boone and Crockett Club, cannot be continued indefinitely. And eight animals—one-fifth of the remaining population—have apparently been killed by motor trucks. Fencing at strategic points, impractical until a refuge is established, appears to be essential. Persons who feel that action should be taken promptly should write to the chairman of the Sub-committee on Fisheries and Wild Life Conservation, Congressman Frank Boykin, House Office Building, Washington 25, D.C. and to their own Congressman.

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LX—No. 10 — **DECEMBER, 1951**

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You will find NATURAL HISTORY Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The spectacular scarlet to vermilion flowers of this Passionflower *(Passiflora vitifolia)* enliven the somber depths of tropical forests from Nicaragua to northern Peru. It is abundant in Panama and Costa Rica, where this picture was taken by Paul H. Allen.

About 400 species of passionflowers are known, mostly from the New World, but a few are native to Asia and the South Pacific islands. Usually they have small greenish or yellow flowers, but a number of fine red ones are known, as well as the large blue types commonly seen by travelers in the West Indies. Residents of southern United States know the maypops *(P. incarnata)* as a common weed in fields.

Early Spanish explorers saw a resemblance to details of the Crucifixion in the peculiar structure of the flower of some tropical species, and this gave rise to both the popular and scientific names. A good many kinds are grown as ornamental vines in European gardens, and at least two species provide the tropical fruits known as granadillas.

H. K. SVENSON.

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SPRING is the high tide of the year, when life comes streaming back to reanimate the scene left desolate by winter. Yet so often the swift transition of spring into summer robs us of its many-sided significance. To capture its elusive charm more completely one must travel with it as it rolls northward through regions of natural beauty, and that is precisely what the author has done. The journey begins appropriately in what is described as a no man's land of the seasons, the Everglades, and moves northward — not always perpendicularly but with interesting crisscrossing of territory to include localities of unusual appeal — until it terminates near the summit of Mount Washington. There an exhausted spring, robbed of its pristine freshness after the long upward climb latitudinally and altitudinally, becomes the counterpart of that season in, let us say, Labrador.

To travel with Teale on the crest of the wave of spring is an exhilarating experience. His joy in the natural scene and his vigilance in detecting its denizens, large or small, assure a constant succession of interesting observations and records of happenings, and these are set down so vividly that the text has as much pictorial quality as the excellent photographs that supplement it.

In the brief space available for this review it is impossible to give more than a hint of the varied and informing content of the volume. Birds are everywhere throughout its pages, singly like the beautiful painted bunting or in great waves such as were witnessed when the migrating warblers poured over the Appalachians. Migrations were not of birds alone. The return flight to the north of the monarch butterflies and the landward migration of the baby eels from their birthplace in the distant ocean depths are narrated with informing comment. There is a chapter devoted to the capture alive of Florida diamondback rattlesnakes. Plants are as ubiquitous throughout the volume as the birds, and a particularly interesting chapter is devoted to those of insectivorous habit, with accounts of certain insects that are adapted to life within the dangerous confines of the plant.

One hesitates to assign pre-eminence to a particular volume in a sequence where each volume has distinctive merit; yet many a reader may feel that in *North with the Spring* Teale has edged even above the high level established by *Grassroot Jungles* and his subsequent publications of comparable stature.

HERBERT F. SCHWARZ

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- - - - - - - - - by Gilbert Klingel

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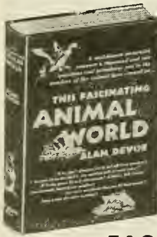

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portance even in death are discussed with insight and feeling.

Above the waterline the sand, the toy of wind and current alike, forms the universe of ghost crabs and fiddlers, and Klingel brings it vividly before our eyes. The finest writing concerns the borders of the Bay, and the chapter on the Chesapeake marshes is a superb piece of word painting in which the world of life is both seen and heard as the tide ebbs and flows, and day passes into the long night and the dawn that follows. Ospreys, Bald Eagles, Blue Herons find their place in this charming book, as well as the marine creatures which dominate it, while the chapter on "The Bay in Time" puts it all in its setting with the past. The sketches by Natalie Davis add considerably to the attractiveness of the book.

N. J. BERRILL

THIS FASCINATING ANIMAL WORLD

- - - - - - - - - - by Alan Devoe

McGraw-Hill Book Co.,
$3.75. 303 pp.

THIS book is written on a question-and-answer basis. It covers a very wide field, treating questions that are likely to occur to the average reader and, in addition, some that are not. The author displays an extensive background of observation and study in providing the answers and a journalistic flair that, on occasion, throws a strain on the credulity of the reader.

Devoe has a complex on formal naturalists, the museum men, and students of natural history who work on it as a profession. As one of this group, I frankly confess it irritates me to read the frequent aspersions and charges laid against us. I admit we naturalists are hard to convince, we are dull as ditch water in much of our research literature, and there is a great deal for us to learn. Devoe has created the term of "animalizer" to describe his own particular field of competence. I am sure the run-of-the-mine naturalist will be agreeable to the segregation. It should be stated that "animalizer" connotes an iconoclastic philosophy toward much accepted natural history and a tendency to create straw men (exemplified by "Prof. X") in the professional field.

It is unfortunate that the review of this provocative book must be confined to such brief space. Chapter and verse should be cited to support the criticism of the reviewer. Much of what Devoe writes in this book will meet with the approval of all readers. He has interesting topics, and his breezy style holds the attention of the reader. It is scarcely necessary to give examples of this.

The items that cause a difference of opinion can be exemplified by "Can porcupines throw their quills? No." "But may you be standing 10 feet from an agitated porcupine and nevertheless get a quill whizzing through your hat? You may." It is difficult for me, having been so situated many times, to imagine the loosened, very light, quill *whizzing* anywhere. It tumbles every which way and its velocity at a distance of 10 feet, and the likelihood of being point-on to go through your hat—? I give up. I guess I was not cut out to be an animalizer.

HAROLD E. ANTHONY

THE FALL OF THE SPARROW

- - - - - - - - - - by Jay Williams,

with an introductory chapter by Stanley Edgar Hyman

Oxford University Press, $3.00
158 pp.

THE extinction of species has been going on for hundreds of millions of years, but it is only recently that Man has become especially concerned with this phenomenon. This is the result of his increasing awareness of the part he has played in the decrease and even in the disappearance of various forms of life, for within historical times, and especially within the last century, destruction by man has become unprecedentedly severe.

The dismal story is told in some detail by Mr. Williams, and one must admire the amount of work that has gone into the compilation of his book. This is a series of case histories dealing with the extinction and the extermination of many species of animals, and throughout the account Man plays the role of the arch-despoiler. Mr. Williams is concerned especially with the retreat of animal life before the onslaughts of comparatively modern humans. It is a long catalogue of sins, including at its end an account of the struggles between men, during the course of which quite a few ethnic groups have vanished as a result of pressures by their aggressive brothers. As a counterbalance to his compendium of death and destruction, the author devotes one chapter to a description of the work being done by modern conservationists in an effort to save species now threat-

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ened and to put to rights an upset balance of nature.

The book will be useful to a public that has become aware of the importance of conservation in the modern world, but it may give a somewhat unbalanced picture to the general reader. The author is aware of the fact that extinction has been going on for a long time—but this point is not sufficiently stressed. Many of the species given the final crushing blow by Man were on their way to extinction anyway. However, it is well to emphasize the impact of modern Man on the life around him.

The book is written in a style intended to be light and amusing but which unfortunately succeeds in being for the most part annoyingly flippant.

Edwin H. Colbert

I CANNOT REST FROM TRAVEL

- - - - - - - - - - by Willard Price

The John Day Company, $4.00
313 pp., 15 photos

IN youth he meant to become a minister. Then adventure in Canada and a brief spell of circuit riding in Ohio taught Willard Price he must first learn more about the world. As a "printer's devil" in New York he earned the price of a steerage ticket to London. On this shoestring began the career of a globe trotter who dreamed of a better world.

After cycling across Europe and returning to New York amid a shipload of Italian immigrants, Price realized he must study journalism. Columbia University rewarded him with an M.A. in 1914. After launching a journal, *World Outlook*, he began a tour of Japan, Korea, and China.

Those were only the first of 70 lands covered in a lifetime of reporting. Besides numerous articles in many periodicals, he wrote more than a dozen informative books. Willard Price writes with skill, insight, and humor. His greatest interests lay in the Far East and Latin America; China and Japan were visited repeatedly; the Indies, Philippines, Micronesia, and North Africa not neglected. He braved the ire of a Moroccan Pasha, outsmarted the Japanese, and in Mindanao consorted with a killer of renown.

The Second World War caught the Prices in France and prompted the reprinting of *Japan's Islands of Mystery* as a source book for strategists. Later Price was studying the new air route across Amazonia, head-shrinking by Jivaro Indians, and animal collecting on the upper Amazon.

These segments from an active lifetime of travel are colorful, amusingly presented, occasionally almost tragic. The author abandoned dogmatism for a warm appreciation of all humanity. Yet his closing note is pessimistic: has our world really progressed in the past half-century? Surely it has. The broader knowledge of our globe, its life, of the structure of the universe, is well worth all our pains. To a better understanding of men and nations Willard Price himself has contributed abundantly.

James P. Chapin

HUMAN FERTILITY

The Modern Dilemma

- - - - - - - - - by Robert C. Cook, with an introduction by Julian Huxley

William Sloane Associates,
$4.50, 380 pp.

A LITTLE over 150 years ago an English clergyman by the name of Malthus wrote a book best known by its short title of *An Essay on the Principle of Population.* The strange paradox about this remarkable work is that although few books since its publication have had greater influence, yet its lessons have been very largely minimized. Malthus pointed out that population tended to increase up to the limit of subsistence. The balance between population and food was achieved only by catastrophic destruction of masses of men through famine, pestilence, and war. In Malthus' day the approach of population to its limit of subsistence provided him with abundant examples of human misery and suffering.

Continued on page 475

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The Mout

A firsthand account of a strange adventure in the black jungles of Dominica—where prodigies of nature meant danger and death to more than one

Somewhat over 100 years ago, an inhabitant of Dominica, British West Indies, decided to traverse the jungles of a little-known section in the southern half of the island. Swinging his cutlass, he hacked himself a path through the dense growth until he was many miles from any known locality or habitation of man.

For hours he pressed on, confident that he would safely come to his destination, but he ascended this peak and descended that ravine, crossed torrents, circumvented cliffs and precipices, without reaching his goal.

Finally he realized that he was lost. He was in the midst of a green jungle, where trees reached with tops unseen to dizzy heights above his head, where long thick lianas hung like snakes from branch to ground, and where the space between the tree trunks was choked with myriad plants, ferns, mosses, decayed and rotting wood, and all manner of tangled growth. He could see but a few feet ahead, and little sunlight filtered down through the thick matting of leaves. He listened, but there was only silence or the gurgling tinkle of a close-by rivulet. Then night closed upon him.

He slept a little; day came, and once more in a somber green maze he wandered, deriving a little subsistence from roots and herbs. Thus nights came, days passed, strength oozed away, death approached him. Finally he thought he heard a sound, like the ringing *whack!* of an ax blade striking a tree. He shouted and was answered, and soon help was at hand. Emaciated, ragged, he had blundered back nine days later to the place from which he had started. When at length he recovered, people questioned him about his experience. What had he seen that was new and of interest in that unknown region of the bush? He answered that he had seen nothing except the everlasting tree trunks, the dangling vines, the dark green riot of vegetation, a few small streams. Yet, there had been something that he had heard in his wanderings, something awful and terrible as of a great roaring far off, and there had come at times a sulphurous smell. Then he had heard it no more, but the sound had increased his fears, for the roar was menacing.

This statement aroused some curiosity and conjecture but no action. Living was hard for most of the colonists, and they had little time to wander in the jungle to seek for something that was not gold. A generation passed, and the story was all but forgotten or thought to represent the vagaries of a lost and half-demented man. Furthermore, the ignorant and superstitious feared to penetrate that bush, for there must be ghosts, demons, and *soucouyants** in it. At length, a more bold and enterprising citizen, with some leisure and a keen sense of curiosity, heard the old tale. He decided to investigate and organized a small expedition. He *found* it! But then, I too found it.

At three one afternoon, I was swinging down the pavement of one of the streets of Roseau, the island's little capital. On my back was a rucksack containing a few necessities and provisions. I was hiking to the hamlet of Laudat six miles distant, where I intended to spend the night before plunging into the mountainous jungle, which contained the famed, little-visited, and mysterious object of this trip.

Crossing the bridge, the first three miles followed the Roseau Valley. This was easy, for it was neither steep nor hot, and it was pleasant to plod along admiring the scenes, listening to the birds, and enjoying the greetings of the natives passing by.

At length the road began to climb. It went up and up, switchbacking in zigzags every few hundred yards and blocked by landslides in many places. More miles, and the route flattened out into a plateau region, and there was Laudat — a tiny hamlet of scattered cabins, little clearings for fruit and garden truck, a tiny church, and a rough clapboard miniature of a building that called itself a store. Here was where I was to stop, and an inquiry directed me to a resthouse kept by one Agnighta Rowle.

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* Vampires that take the form of a huge moth or firefly and suck the blood of sleeping victims.

Agnighta—"Little Lamb"—proved to be a pleasant-featured young colored woman. With evident pride, she showed me her resthouse, which consisted of a kitchen, a dining-sitting room, and three small bedrooms. There was a porch, and though the cabin and its rooms were tiny, all were swept, scrubbed, and spotlessly clean.

A simple supper and an early bed, but after three hours I awoke. Perhaps it was the cold, for Laudat is 1800 feet above the sea and I had but a sheet over me, but perhaps it was something else. At any rate it was quite light, and I went out onto the porch to look around and smoke a cigarette.

It was the time of the full moon, and the great disk was riding high in the dark sky, revealing the earth almost as in daylight. There lay the moonlight on the clearings, casting shadows of branches like lacework, and the cabins half in silver, half in darkness, the somber background of the jungle, and the country sweeping downward, to where it met the starlit sea. At my back, hanging right over the village, loomed a vague and velvet-dark immensity—mighty Morne Microtin, a jungle-choked, dormant volcano, whose top they say has never been

f Hell

By Stuart E. Elliott

▼ A PORTION of the Valley of Desolation, with vapors from the boiling lake rising in the background at left

▲ THE PICTURESQUE PORT of Roseau in the island of Dominica, in whose wild interior the events narrated in this article occurred

▲ AGNIGHTA and the guide Cyril Rowle at the Rest House

▼ A STREET in the capital city of Roseau

explored. All was peaceful and quiet, save for the sounds of the insects. Then, these were hushed and the silence was complete.

Suddenly, as if from afar, there came a deep rumble — faint yet great. It grew in intensity like the sound of an approaching train, and then the ground began to rock and the house began to sway. At first gently, then harder, until the beams creaked and cried, and the cabin rocked. In a short time it was over, with no damage; but it seemed that the quiescent, fire-belching demon beneath these mountains had stirred a little in his sleep.

The next morning, I was up with the rejoicing birds. After breakfast, Cyril Rowle, Agnighta's brother, who was to be my guide, came over. He was a medium-tall, wiry and intelligent-looking mulatto of around forty, who had a regular job with the Public Works Department of the island; but Laudat was his home, and no one knew the interior jungles better than he. The colony's administration had licensed him as a guide for such regions.

Cyril had with him a younger Negro, as porter for our trip. The contrast was marked. The guide's clothes were neat; he wore shoes, and his bearing had the grave dignity of one far above the ordinary countryfolk. The porter was a shuffling, grinning black, raggedy and barefoot.

Cyril cut us two long pilgrim staffs, and we set out. For a mile we followed a tolerable trail, well used, since we were still among the sugar canes and banana bushes of the villagers. Then the trail dwindled to a faint trace, and the gloom of the jungle covered us. This path was rough and hard to follow. There were sharp rocks and slippery stones, and the space between was mud, with frequent sloughs and quagmires from the constant rains and showers. It was uncertain footing from the start.

Another mile, and we came to a place in a deep glen where a mighty mountain chestnut had crashed to bridge a dreadful chasm. This was Titou, a gap not more than twelve feet wide but of a fearful depth. Gripping the rough handrail, I ventured onto the fallen trunk, then stopped and peered down into a blackness. Close to each edge and arching over grew thick bushes; but parting them, one could see a gash with perpendicular walls, and far down—120 feet by plumb line—the white gleam of a torrent. This stream was like a shining hacksaw, deep in some cut of gray iron. It was like looking into a rodent ulcer, gnawing deep into the skin of the earth. Yet the bushes all but utterly concealed the gap, making a trap for the unwary.

"Cyril," I said. "Has anyone ever fallen in?"

He considered. "No man I know of," he answered, "but my poor dog did. He was a good dog, but he slipped on this log and fell. He fell straight without glancing either side and reached the water alive. I flashed my light and saw him try to swim, and he barked for help, but the current swept him quickly down."

"And then?"

"I tried to follow along the top, in hope the stream would surface not too far away. But I could not go fast enough, and I never saw my dog again. I think a whirlpool got him, or else he went over some high waterfall before he reached the river. I was very sorry he died."

▲ A SECTION of the infernal gulch. The author is at the far right

▲ A REST on the way down to the boiling brook

"But," said I, "you could never expect any sort of chance from that awful place."

"You think not? Listen! A man I know had a worthless dog, a chicken killer, so he took him here and threw him in. He, too, fell without touching the sides and struck the water quite alive. Then this man went home thinking he was well rid of him, but when he reached his house, the dog was there waiting for him, and no bones broken. He was a bad dog, but he was a strong swimmer."

This was Cyril's tale, and one thought, "like men like dogs," the bad penny turns up.

We trod on for miles through the green gloom of the jungle. Surefooted, cutlass in hand, Cyril strode ahead. He knew every rock, every projecting root on the trail, and he did not slip or catch his foot. Behind, I came in rubber-soled shoes that slipped like soap on the rounded, glistening stones and had little grip in the viscous mud. At our rear pattered our porter, who never slipped. His soles were a half inch thick with callouses and were as tough as a tapir's hide; and his toes, unwarped by any artificiality, were broad and straight and widely spread. When he stepped on a slippery rock, his toes curled around the edge and gripped almost like the clutch of a bird.

Another hour, and there was a natural clearing, where a landslide had wiped the forest from the slope of a steep ravine. We descended, and for the first time there came a faint sulphurous smell. Cyril nodded and halted beside a little stream. "Hear anything?" he said.

"Like a roaring, way off? But I am not sure."

"That's it. Today it's rather quiet. Sometimes it's like a lion."

"We must be getting near."

"Two hours more of trail. Tired?"

"Me? Never! Let's go." We

▼ ALONG the rugged trail between Roseau and Laudat

A WATERFALL along the trail to Laudat

crossed the stream that split this gulch in two.

But now our trail, so far no easy path, became far more arduous. A green wall faced us, and up we went. Up and up, at an angle of 60 degrees or more, and here we needed handwork as well as footwork. Anyone who follows this trail needs tough muscles, for there is work such as Jack did climbing his Beanstalk. Bending our legs repeatedly until our knees met the level of our chins, we grabbed roots and snatched bushes, while underfoot the mud was oozy and a pattering drizzle on myriad leaves dripped rain upon our faces. We climbed and climbed and climbed again, and kept on climbing.

At last we reached a kind of semi-level and followed a gradually rising ridge. This was not over 4 feet wide, with precipitous slopes descending some 1500 feet, until they ended in an uninterrupted green maze far below. Across this razor-backed trail, we came upon the skeleton and feathers of a bird.

"Wild cat!" said Cyril, turning over the remains with his toe. He then spoke of the animals of this jungle. There were the agouti and the deer and the cats. These last were many generations removed from their domestic forebears and had grown large and powerful in their savage state. There were also once-domestic sheep, now ranging wild, and there were goats and wild cattle; the latter could prove ugly customers on occasion.

However, the only really dangerous animal was the pig—runaway descendents of domestic swine—and they were numerous. The boars had developed into ferocious, shaggy creatures, armed with long razor-sharp tusks. Unmolested, they avoided man; but when hunted with dogs—an island sport—they charged like lions. Many dogs were killed on these hunts, and men, too, sometimes.

We noticed hawks and once glimpsed a flash of something red and green that might have been the famed Imperial Parrot, a bird seldom seen. It is a fine large bird found only in Dominica—indeed, only in the most inaccessible fastnesses of the island. Then a small green snake slithered across our path. We paid small attention to it, for although there are twelve-foot boa constrictors on Dominica, they are rarely seen and are mere harmless chicken stealers. There are no poisonous snakes—which is a comfort when traversing the Dominican jungles.

On near-by Martinique, not 30 miles south over blue waters, the deadly fer-de-lance lurks everywhere—in jungle, kitchen garden, and even in the heart of town after nightfall—and his fangs are worse than any rattler's. Why in all the years that the fer-de-lance has terrorized the barefoot inhabitants of Martinique, it has never crossed the channel as a passenger on driftwood seems rare good luck, especially as it has been found secreted on small boats plying between the islands.

Our hogback trail now turned a bit more sharply upward. Another ten minutes and we came to a place where the trees had given way to low shrubs, over which we could peer into the distance. We stopped. We were on the topmost point of Morne Nicoll, 4000 feet above Roseau and the sea. Here the peak was no more than 5 feet square, and on all sides the slopes descended from 50 to 60 degrees, until they

THE AUTHOR and his companion after a third trip to the Lake faded away in the green immensity far beneath. We were like three microbes resting on a needle point.

Cyril stretched forth a lean, brown hand. "Do you see?" he pointed. Everywhere a confusion of high, steep, conelike peaks; everywhere acutely apexed pyramids, green for the most part, save where a landslide had left great red and yellowish scars on some steep flank. They looked like drawings of mountains done by children — verdant cones, shaped like ice-cream sellers' cornucopias, like the naive illustrations in Van Loon's *Geography.*

There was no order in them, and unlike the calm and steadfast grandeur of our Rockies or White Mountains, these hills seemed insane in both shape and confused array—a jumbled assemblage of dormant volcanoes. However, it was not to this weird picture that Cyril was drawing my attention. These slumbering, crazy-looking peaks only formed a sort of ring, a crowding irregular ring, like gapers at some dangerous object.

Below our feet lay a valley, or rather two valleys, for low spurs and obstructions somewhat divided it in two. At the end of the farther part rose a billowing cloud of steam. Then a wind seemed to rip this asunder, and I glimpsed a smutty, blackened cliff that curved concavely as if it were the inner side of a gigantic stewpot. As a bird might have flown, if any birds ever flew over that region, it seemed a mile or so away.

"So that's it?" I said, and Cyril nodded. "Well, it can't be long from here."

"It will take a good hour," he said gravely. "By far the worst is still ahead."

We now descended. Our route was a six-inch gutter of mud and treacherous stones which zigzagged back and forth. Grass, horrid and coarse, grew a foot high on each side, the mud slid, rounded stones rolled and bounded down if one trod carelessly, and from below came curling wisps and swirling clouds of vapor. Our path lay along a steep declivity that curved concavely like a funnel. It was as if we were descending the bell-shaped mouth of a huge blunderbuss, and at one time this curving slope had been something very similar.

At length, the bottom. On all sides were high, bare, curving slopes, blasted and withered, devoid of growing things. Carefully, we picked our way over a lozenge-shaped area of a few acres. There were sharp rocks and white and yellow, crusty, sickly-looking earth that crumbled underfoot. There were jets of steam, hissing spouts, fumaroles, and boiling springs that one might cook in. There were tiny vents in the earth's crust from which intense heat came. Everywhere water and steam hissed, spouted, and burbled.

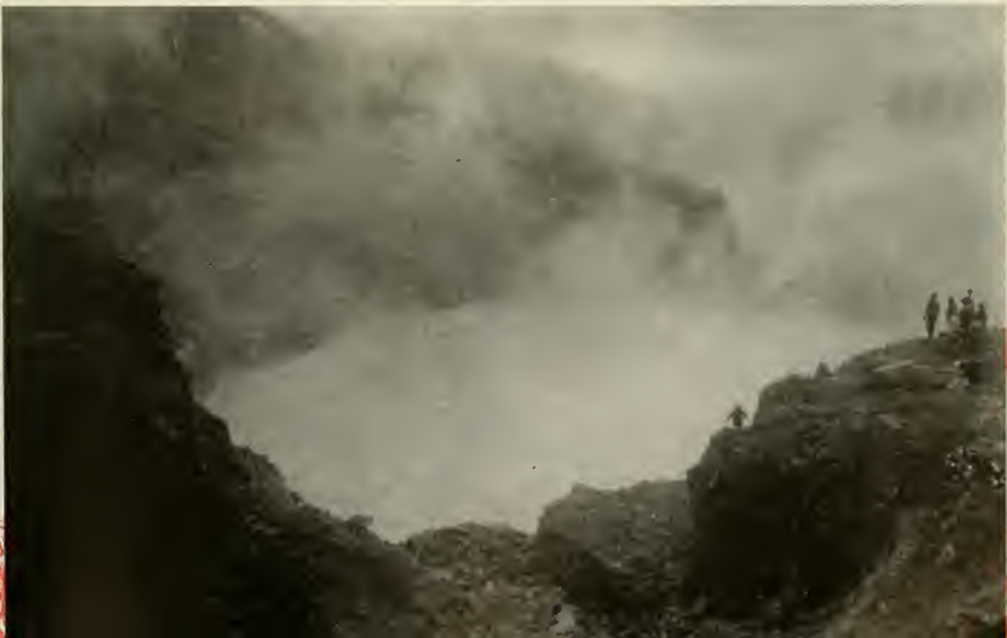
Through clouds of steam we traversed this infernal gulch on carefully chosen rocks, watching each step lest an unnoticed vent scald foot or ankle. The only outlet was by a stream discharging through a canyon, very narrow and with high unclimbable walls. Our only path lay along the bed of this stream, whose waters bubbled and steamed, actively boiling.

For a good half mile we followed this torrent, stepping and sometimes leaping from rock to slippery boulder, constantly crossing and recrossing. There were many boiling pools four feet deep to hop over, and a misstep could have meant a painful death.

At length, on our left, another boiling brook joined the waters of our stream, and up this we turned

Continued on page 476

▼ THE BOILING LAKE, where huge bubbles are known to have extinguished human life



The Nesting o

The first nest of the Black Swift ever found in Colorado is discovered almost two miles above sea level, in the icy spray of a mountain chasm

By John A. Murphy, Jr.
Denver Museum of Natural History

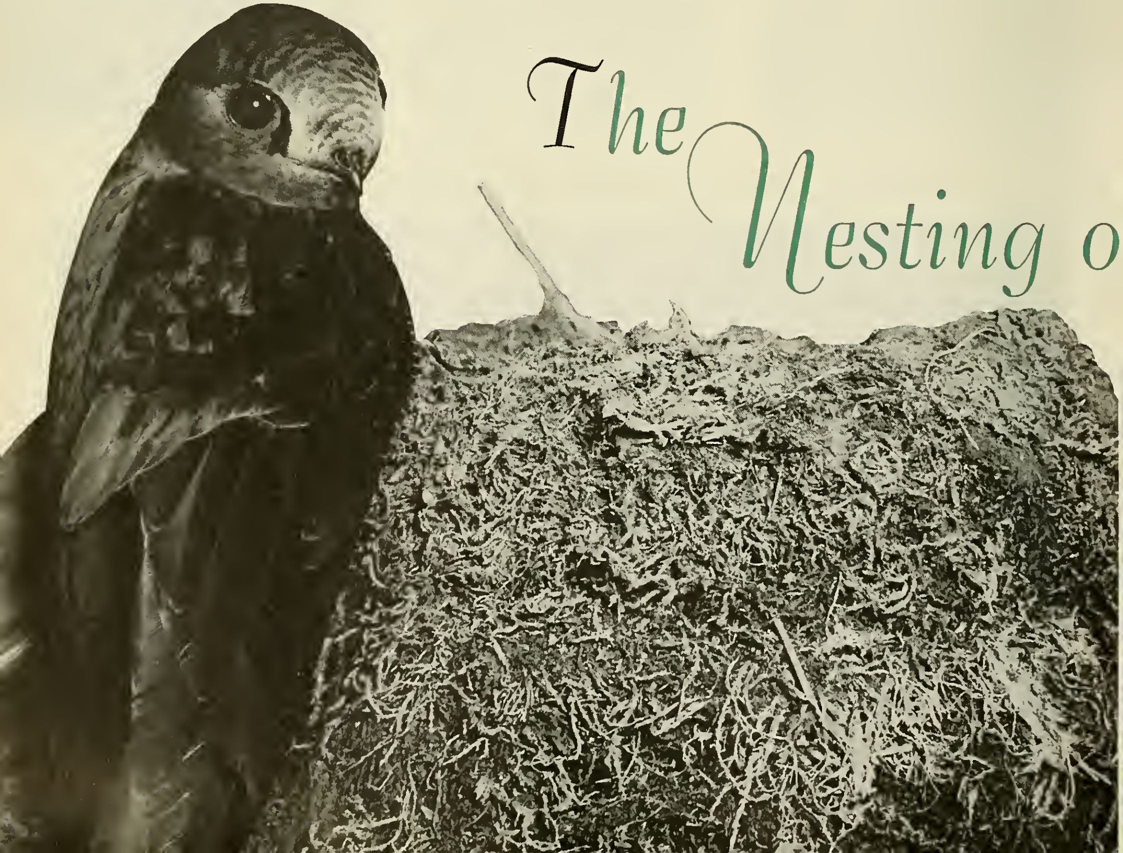
Photographs by the author, courtesy of the Denver Museum of Natural History

TWO years ago I was sent by the Denver Museum of Natural History to learn something of the nesting habits of the Black Swift. Considering the fact that not one nest of this bird had ever been found in Colorado, the mission was something of a challenge. In the early '80's, the bird had been reported to exist in the high mountains of the southwestern part of the state, but we had not heard much about it since then. With the late Robert Landberg, I combed the canyons and mountaintops, but our work was almost a complete failure.

Then this last season, Curator of Birds Robert J. Niedrach sent Lang Baily of the Museum staff and Al Knorr to work the country adjacent to Silverton in the high San Juans. These tireless bird students located nests on steep canyon walls in almost inaccessible locations near Howardsville and one on the South Fork of Mineral Creek. It might conceivably be possible to photograph the latter one.

I was delegated to secure pictures of these birds on their nests, and I joined Baily and Knorr on July 2 at Silverton, a mining settlement in a picturesque valley dominated by great mountains. We borrowed two twenty-foot extension ladders and headed up the valley between towering hills to a series of waterfalls. We had a job getting the ladders up the hill, for the steep slopes were covered with low brush and down timber. We were on our hands and knees much of the time as we inched the ladders upward. It took us one hour to travel 300 feet.

Finally, we wormed the ladder to



▲ In the domain of the Black Swift: a view of Red Mountain in the San Juans

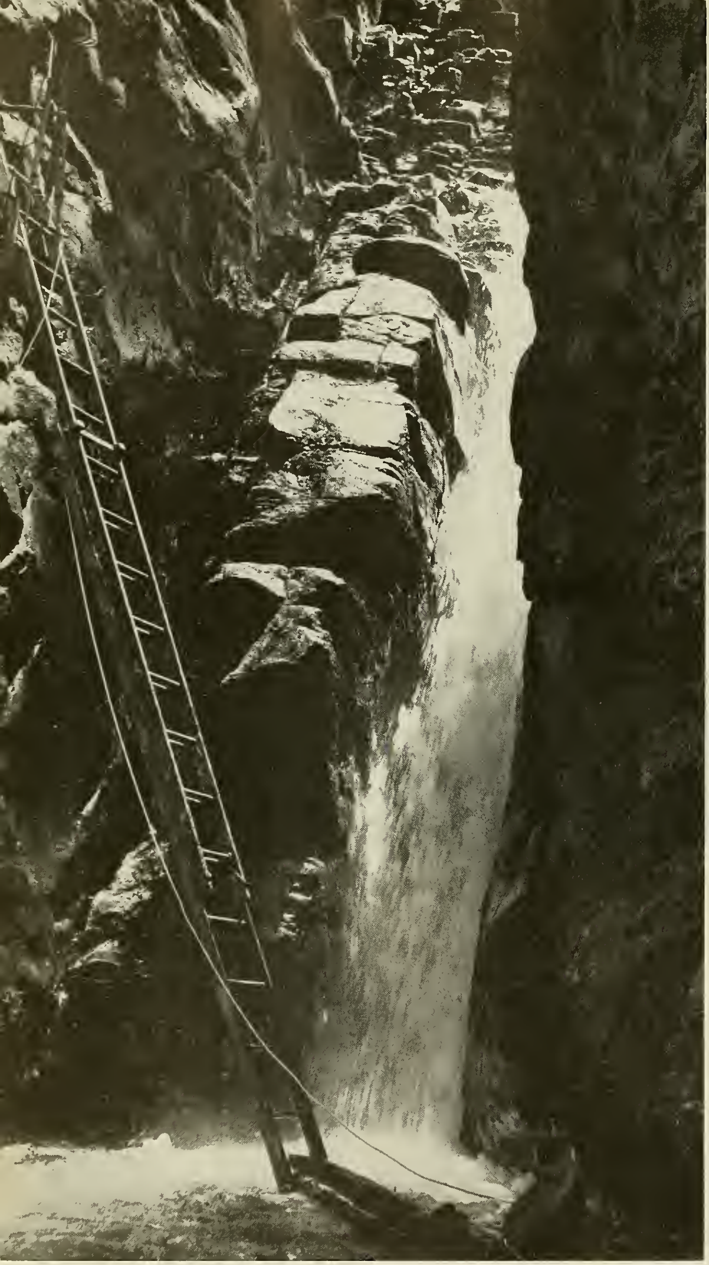
the Black Swift

the foot of the fall below the nest, and the discoverers of this first Colorado nest of the Black Swift pointed out the canopy high above.

From one place on the rocks on the upper side of the canyon, we could see the nest through our binoculars. But there was no bird upon it. The place was wild and picturesque—a narrow canyon with 4 levels of falls towering above, each with a drop of 50 feet or more. The water cascading from the snow-capped crests of the jagged San Juans was ice cold, for we were at an elevation of about 10,500 feet. The lowest waterfall was 20 feet wide at the top, and it plunged 40 or 50 feet into a pool of water about 5 feet deep, in which the current was very swift. The nest was directly above this, and the ladder had to slope across it. The canyon was so narrow that there were only fifteen minutes of sunlight each day, and no direct light at all ever entered the area where the nest was.

We had a tough time erecting the ladder. Lang Baily stood waist-deep in the ice-cold water holding the bottom, while Knorr and I slowly heaved it into place. Then the extension was raised until we had a look into the nest and saw the first egg recorded for this bird in Colorado, so far as we knew.

The nest was made of tightly-packed moss, about eight inches wide at the base and five at the top. There were several levels differing in color, indicating that the nest had been used through several years, with new material added each season. The moisture made the nest look fresh and green, almost as though the moss were growing. The cup was only about



▲ WHERE THE AUTHOR spent many hours drenched in clammy spray, taking these photographs of the Black Swift. The nest was on a ledge in a cavity with walls behind sloping up and out over the nest

three-quarters of an inch deep and was lined with dead pine needles, which were brown and brittle. The single egg always seemed to have the widest part toward the face of the cliff during my observation. The color was white, with a mottling of faint pink in a band around the egg. Considerable moisture was caused by a downdraft, and the temperature in the area was sometimes as low as 32 to 34 degrees.

We sighted birds circling, and, as we did not want to risk their leaving the area, we left the ladder against the wall and made our way to the car.

I returned alone to the nest the following day. At my first appearance, the bird quickly left the nest. So I rapidly fastened the tripod to the top of the ladder and left it so that the old swift could become acquainted with it.

When I returned on July 29 at 7:00 A.M., the incubating bird remained on her egg until I climbed halfway up the ladder. Then I put the camera in place, but it was so dark that I had difficulty focusing; then I took up my observation post at the foot of the cliff. From this position I saw the bird come and go a number of times. It was disappointing to have to leave late that afternoon without any pictures, but the light had been too poor, and I had to remove the camera each time to protect it from the weather.

The next day, I back-packed all my flash equipment, and it was quite a job. This time I set everything up for an extension flash. Working fast, I soon had everything ready to take a picture from an observation ledge. The bird fooled me. I waited an hour, thinking the nest was still empty, when suddenly the bird flew off. She returned again in five minutes, however. I pressed the button and had my first picture—the first of a Colorado nesting Black Swift, so far as I know. The bird darted from the nest at top speed and was gone. When she returned seventeen minutes later, I left her to incubate in peace.

In the ensuing days the bird got quite used to me, and once she alighted on the ledge so close I could have touched her.

I shall not tell of the many hours I waited and watched, drenched most of the time by spray carried in the downdraft. On August 17, the egg was pipped with a slight crack around the center. When I returned in midafternoon, half the shell was on the nesting ledge and the other half crushed in the bottom, and there was a tiny new Black Swift in the nest. The incubation period was approximately 24 days. The young one was a little fellow with tightly closed eyes, and the anxious parent flew about my head.

The two adults were slightly different in size, and the smaller of the two, which I took to be the female, was darker. The other was more mottled and had considerable gray on the back. When both were away from the nest, the coal-black youngster kept moving its wings spasmodically. The nest was always very clean. Occasionally both adults would be upon the nest at the same time, one giving food to the other.

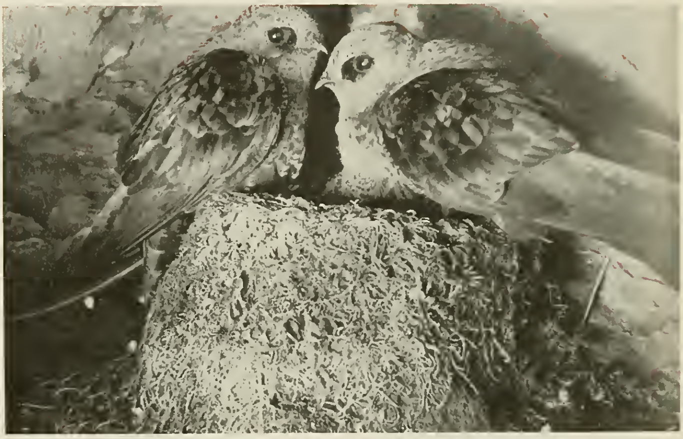
By September 9, the young bird was about a third the size of its parents, and its wing feathers, though not quite developed, were edged with white. I constantly marveled at the hardihood of these high-altitude birds, nesting in the shadows on sheer rock walls that were like refrigerators during the entire season.

As the days passed, the adults stayed away longer, and Junior became more active. The young bird seemed to know when to expect the arrival of the parent. It would face toward the open with its neck resting upon the edge of the nest and, with flapping outstretched wings, give peculiar high-pitched notes. On September 13, the feeding was at 7:45 A.M., but although I remained until 6:45 in the evening, neither of the parents returned.

The adults had been growing wilder. They would feed the young one in a hurry and take off immediately; and there were half a dozen other birds of their kind in the air. The next day, the young one was gone, and there were no adults to be seen.

It had been a strenuous bit of bird watching, and I was content to retire to lower altitudes; but I am glad to have had the privilege of those days afield in the high San Juans of Colorado.

▲ THE PARENT BIRDS were suspicious of the photographer. At one point he dismantled his photographic equipment lest the egg become chilled through their absence



▲ AS TIME WENT ON, the birds showed less anxiety. Sometimes they both remained on the nest at once

▼ AFTER approximately 24 days of incubation, a coal-black youngster emerged from the egg. Twenty-nine days later all of the swifts departed

Novel sound effects distinguish a new exhibit recently opened
at the American Museum of Natural History portraying
the primitive life of the Peruvian rain forest

Men of the Montaña

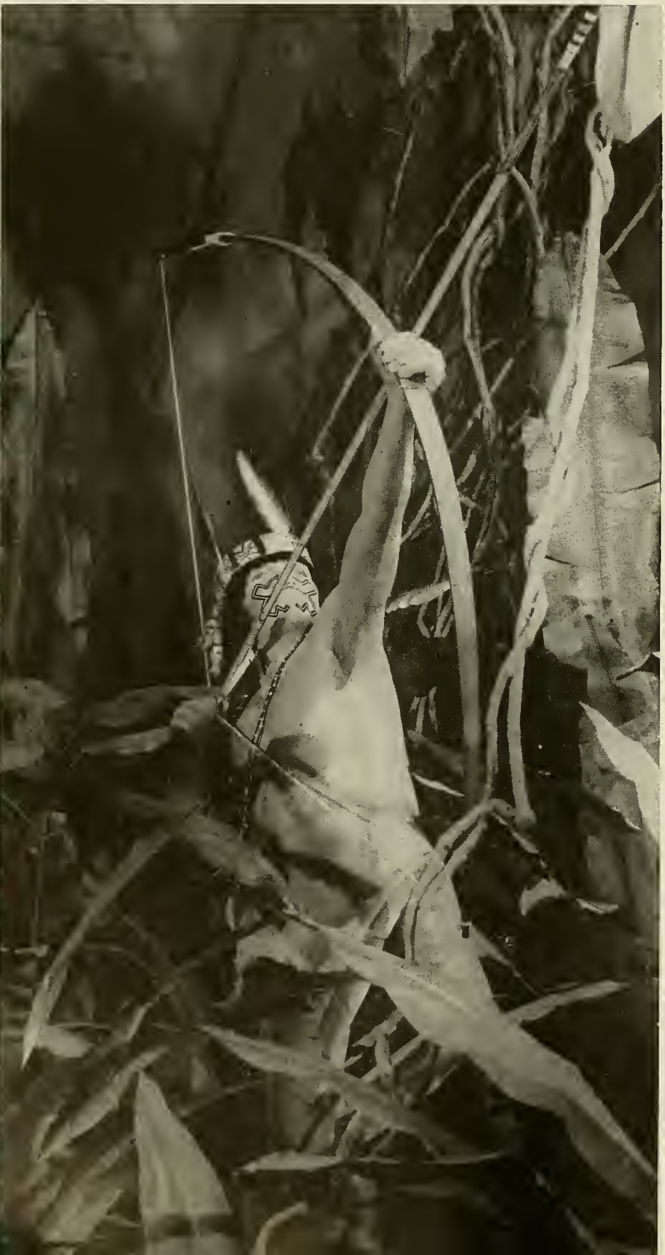
By Harry Tschopik, Jr.

Assistant Curator of Ethnology
American Museum of Natural History

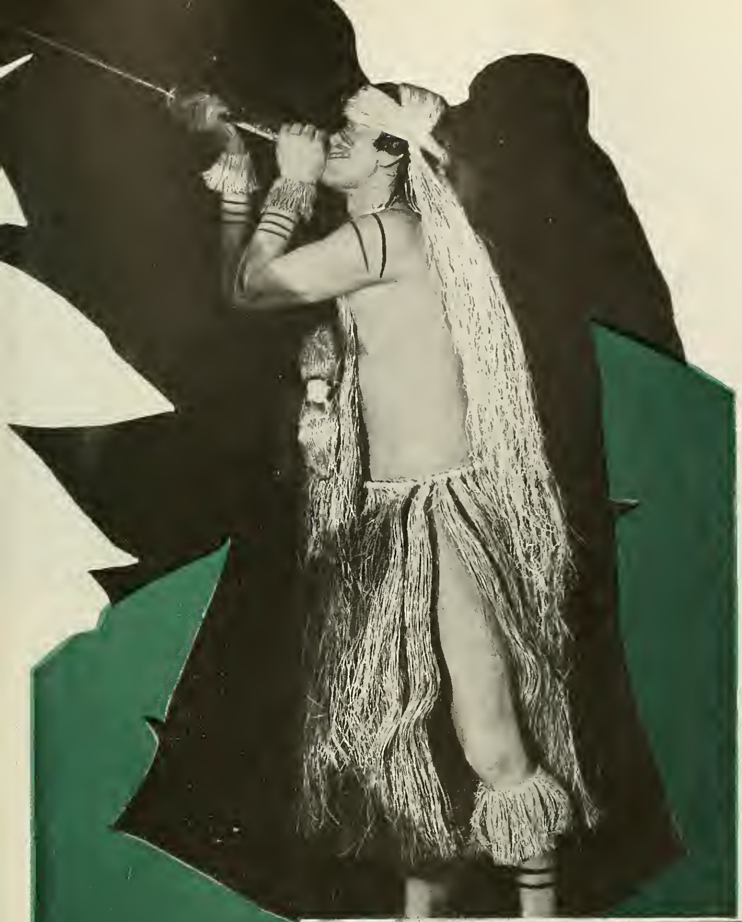
All photos by A. M. N. H.

How could a man be transported in five minutes from New York City to the heart of the rain forest of tropical South America? How could he be dropped down into the daily life of a primitive Indian settlement thousands of miles distant and centuries away in terms of cultural development? That was the problem that faced us at the American Museum in assembling for public display one of the most remarkable collections of native articles ever brought out of the little-known corner of the Amazonian headwaters known as the Montaña.

To show the material in its proper setting we had to build a rain forest and record the sounds that the forest makes. The result is startling. A museum visitor who a moment before was a part of the wintry turmoil of metropolitan traffic suddenly steps into the soft green light of the tropical forest and hears the bark of howler monkeys and the cries of parrots, macaws, toucans, and bell birds against a background of torrential rain.

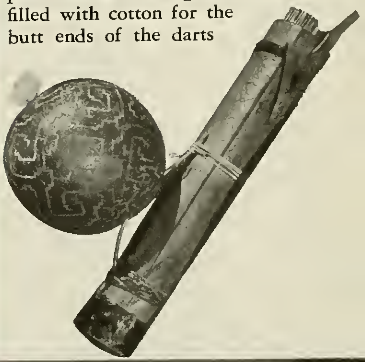


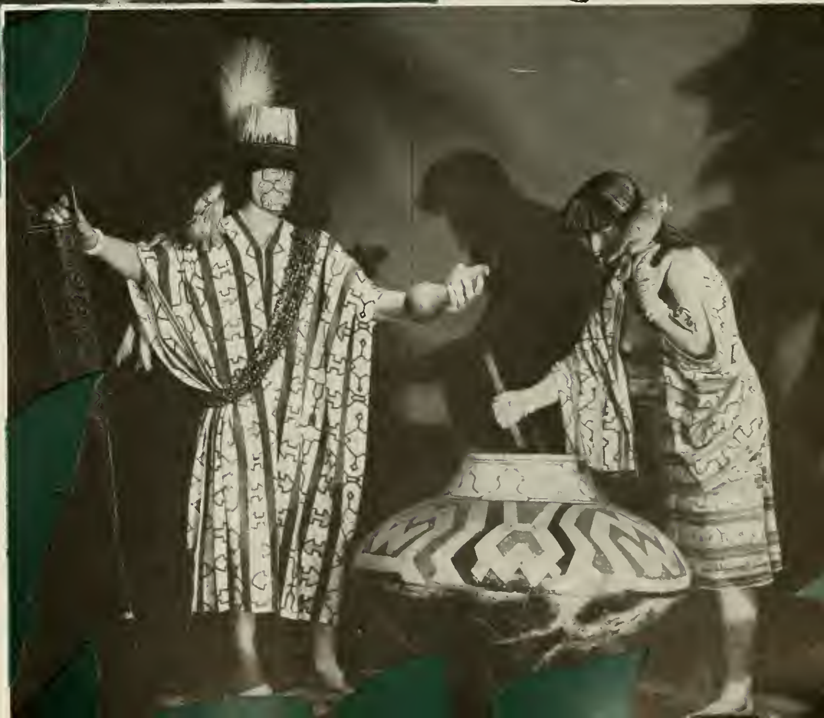
◄A warrior of the Cashibo tribe embarking on a head-hunting expedition. Long shots across a village clearing are executed by pointing the arrow high as shown here. The warrior would not poison the arrow except for use against animals. The Indians believe that curare would lose its effects if used against man. But the warrior will spend more time decorating this arrow than he would any implement not used in warfare



◂ Eight- or nine-foot blowguns are among the principal hunting weapons of the Montaña tribes today. The Yagua hunter shown here carries a well-filled dart case around his neck. The darts will be poisoned with curare, the manufacture of which has long been a monopoly among a few tribes, who traded it widely throughout the region. The container for the curare, concealed behind the dart case, is—of all things—an aspirin bottle. This is one of the few evidences of civilized influence to be found among this remote tribe today

▾ Another type of dart case, used by the tribes of the Ucayali River region. The darts are made of the midribs of palm leaves. The gourd container is filled with cotton for the butt ends of the darts

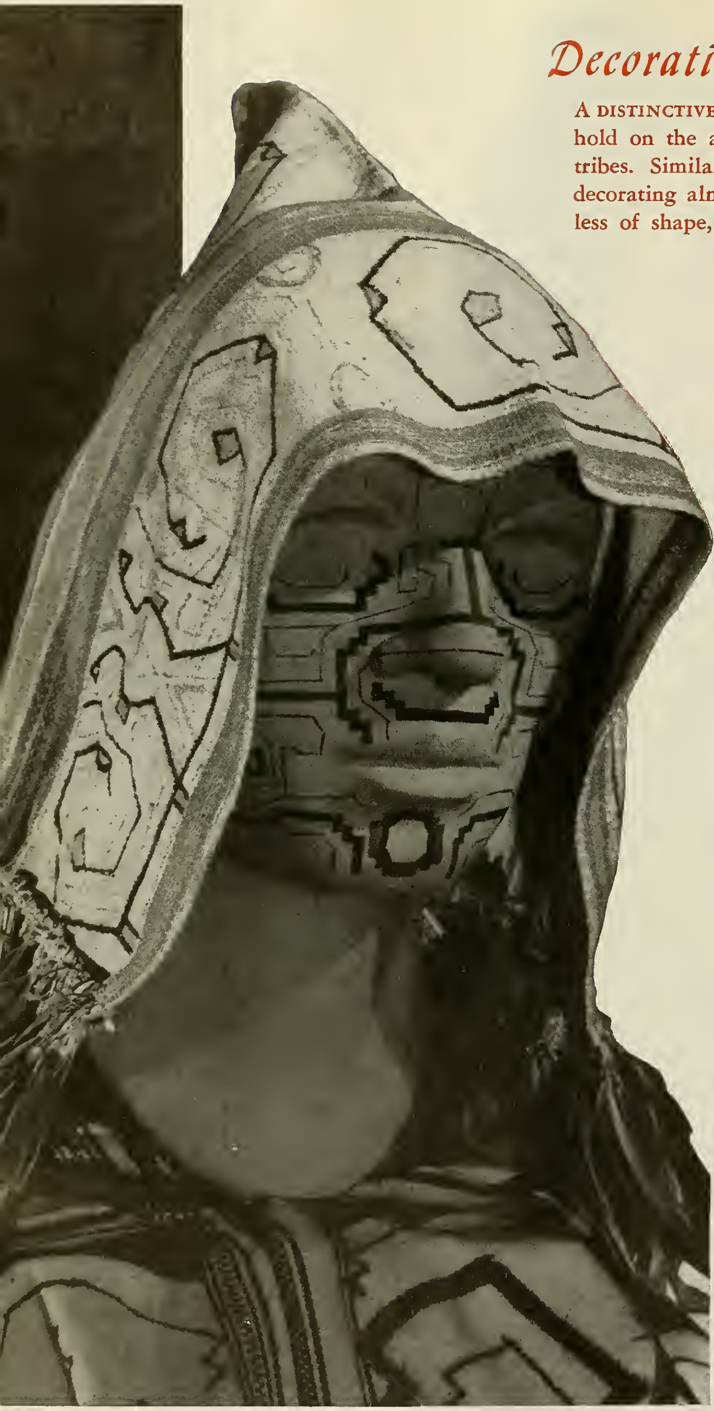




➤ Beer drinking bouts were held to honor adolescent girls, to celebrate successful war parties, and on numerous other occasions. The beer was made from corn, manioc, or sweet potatoes, chewed and fermented, and finally strained through a basketry sieve. The man thirstily extends a gourd cup, while the woman serves. Pet parrots, monkeys, and other animals were kept in great numbers by the tribes of the Montaña

Decorative Style

A DISTINCTIVE decorative style has taken a strong hold on the artistic expression of the Montaña tribes. Similar or identical designs are used for decorating almost everything they make regardless of shape, texture, or material

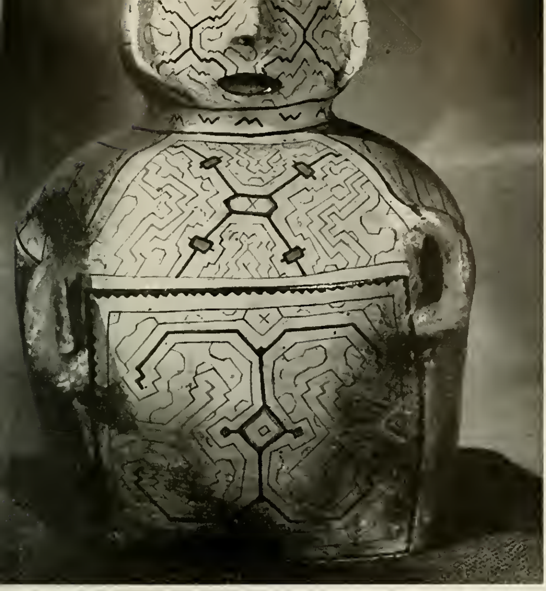


▲ BEFORE THE WHITE MAN came, the Montaña people wore no clothing except for ornaments or during ceremonies. Concepts of modesty were introduced by Catholic missionaries, who may have suggested the idea of the hood

The tribes depicted in the exhibit occupy an inaccessible region of eastern Peru—a land of forest-covered mountains and rapid streams that stretches eastward from the foot of the Andean chain. Even though the area seems impossibly remote from the modern world, it has touched upon the lives of all of us. Quinine and cocaine are products native to the Montaña, and barbasco, now commercially important in the manufacture of insecticides, was first discovered by the Indians of the upper Amazon as a drug used to catch fish. During the last war, when the Malayan supply of rubber was cut off by Japanese conquest, Montaña sources were a vital factor in the Allied war effort. It was rubber, in fact, that led originally to the acquisition of the Museum's Montaña collection, for it was assembled over a period of 25 years by Raúl de los Ríos, a Peruvian planter.

The late Francis Adams Truslow met de los Ríos and saw these treasures when he was in charge of the U. S. Government project for finding new sources of rubber during the war. De los Ríos was obviously a careful and scholarly collector. He had taken pains to store the specimens in beautifully made boxes, many of them of tropical mahogany. Truslow at once sought a means of purchasing the collection for science. He graciously arranged for a foundation to buy it, and thus it became the property of the American Museum.

The first white men to enter the Montaña were the sixteenth-century Spanish conquistadors, who made brief explorations of the Amazon headwaters in search of gold. Few colonists followed their



▲ An effigy pot bearing the same type of geometric designs that were used in painting the face

▲ Some tobacco pipes, carved of wood and decorated with engraved designs, weigh as much as three pounds

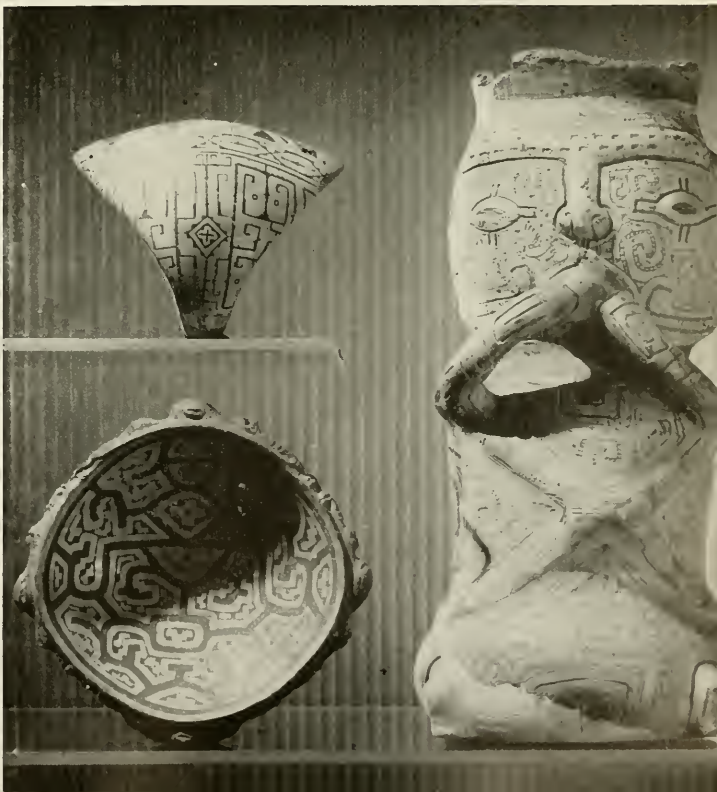
▲ A decorated war club

➤ A Similar art style, though drawn in smaller scale, was used to embellish this lip ornament. This ornament hung from the lower lip, in a perforation made to receive the skewer at one end

wake. Except for the sporadic activities of missionaries, the inhospitable Montaña was largely ignored by the civilized world until the above-mentioned plant resources, especially rubber, attracted the white man in numbers at the turn of the century. Even so, the region has received little attention from scientists and is almost unknown to the public. In fact, until the present effort, no museum in the United States has ever before featured material from the vast rain forest of the Amazon Basin.

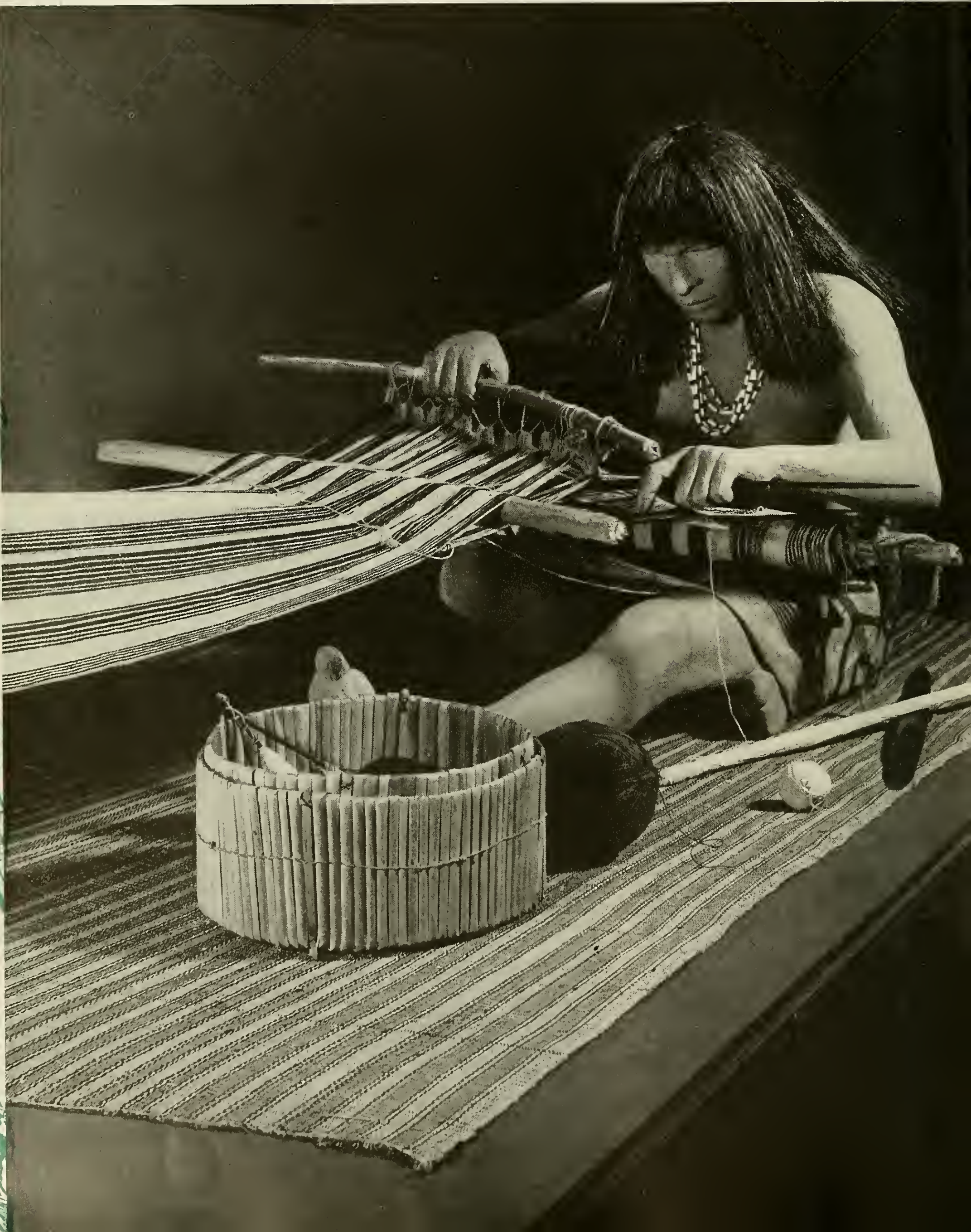
The Montaña tribes are noteworthy in other respects. Although their homeland lies in the very foothills of the Andes, they have been little influenced by the highly civilized peoples of highland Peru. Instead, because the rivers of the Amazon system have long served as routes of trade and communication, the Indians of the Montaña share much in common with tribes living thousands of miles away downstream to the east. Yet in spite of these contacts, the tribes of the Amazon headwaters have until recently remained primitive and backward even by Amazonian standards.

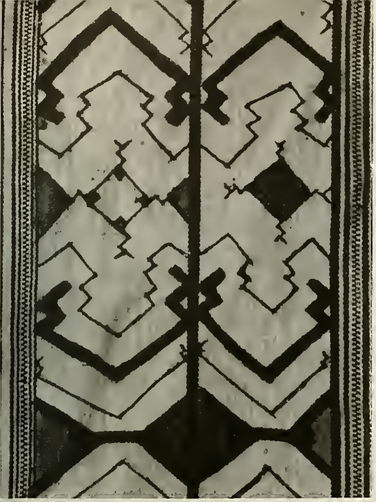
▼ A similar decorative style found 2000 miles away: objects fashioned by the ancient peoples of Marajó in the Amazon delta. Although it is not known where this style originated, the resemblance is too striking to be coincidental. The pottery excavated on this island includes effigy jars, bowls, and pottery *tangas,* or fig leaves, worn by the women (*upper left*)



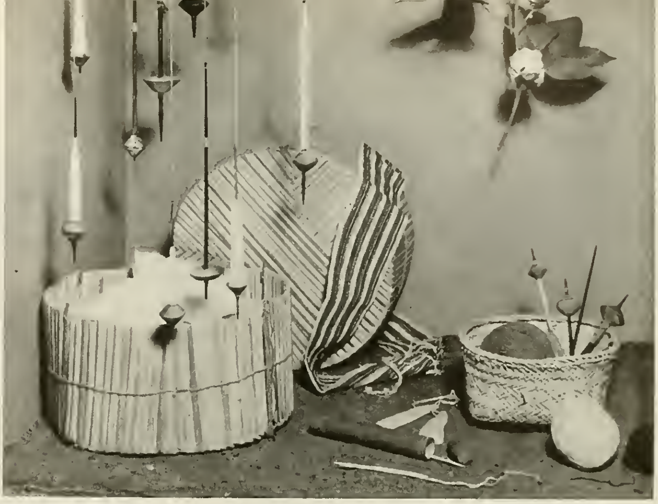
Weaving

▼ THE USE of the horizontal belt loom is one of the few elements of culture the Montaña people share with the Incas and their predecessors. The tribes of the rain forest used looms of this type for weaving shirts, as well as skirts and shawls for the women





▲ TYPICAL of their textiles, this example of otton cloth bears the traditional geometric ecorations, which are painted on after the loth is woven. The parallel stripes, how- ver, were woven in



▲ COTTON of both the white and brown varieties is grown by most of the tribes of the Montaña, except for the Campa and Piro, who gather it wild. The fibers are carefully cleaned by hand and are then spun into thread on a drop spindle like the ones shown here—another type of implement that may show influence from the Andean highland

In their heyday, the Montaña peoples were extremely warlike, taking and shrinking the heads of their slain enemies. They lived in small, mutually hostile families scattered over an area equal to that of Arizona and New Mexico combined. The total population of the Montaña, however, probably never exceeded that of Syracuse, New York. Here, in constant fear of ambush by neighboring groups, the members of each household slashed their fields out of the luxuriant jungle and hunted and fished along the rivers, moving on to new territory whenever the thin tropical soil and the game supply became exhausted.

At present, head-hunting has almost disappeared and warfare is on the wane as the white man's civilization penetrates more deeply into the Amazon headwaters. Paradoxically, it is possible to see more of traditional Montaña life today in New York City than in the rain forest of eastern Peru.

▼ MANIOC, the most important of the tropical root crops, has been called the staff of life of the Amazonian lowlands. The tubers of the sweet variety are shown here, together with graters, strainers, and other implements used in the preparation of this food. The poisonous manioc, which is processed for food widely elsewhere in the tropical forest and is our source of tapioca, is not grown in the Montaña

Thus with relatively few personal possessions and a technology exceedingly simple by our standards, the tribes of the Montaña have nevertheless adapted themselves well to the conditions imposed by their tropical environment

▲ A SIGHT VISITORS to Africa always remember—the mighty baobab surrounded by lush vegetation

The Tree that Time Forgot

A candidate for nomination as one of the Seven Wonders of natural history is the monstrous baobab, mystery tree of Africa

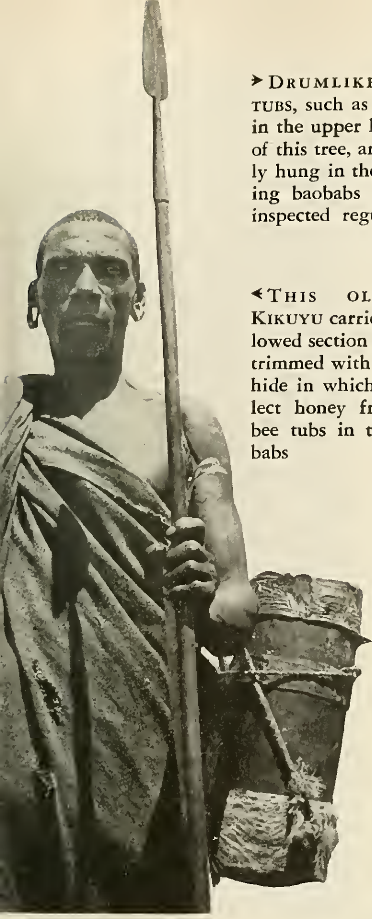
By RUSSELL BARNETT AITKEN

Photographs by the author

FOR 6000 years of recorded history Africa's savage songs have been chanted to the pounding of primitive drums. Since we call this skull-shaped continent the traditional home of Mumbo Jumbo and mystery, perhaps it is fitting that one of its trees should remain something of an enigma. It is the giant of jungle and veldt known as the baobab (pronounced BAY-o-bab).

Botanists argue as to the age it attains. Settlers declare it to be so ancient that no young trees of the species have ever been seen. A pioneer big-game hunter, William Cotton Oswell, agreed with this and claimed moreover that the smallest he had encountered measured 45 feet in circumference. There are others who solemnly believe that venerable baobabs standing on the coast in all probability once looked aloofly at Roman and Athenian galleys, and that the royal barge of Cleopatra herself may have saluted them when she sailed southward to view the land that had supplied her with gold, ivory, leopards, and slaves. This romantic notion is scoffed at by modern scientists, who point out that records exist of the tree commencing to fruit at eight to ten years and that a specimen planted in India was as big at 300 years as one that was claimed to be 5000 years old by its discoverer. But no one can dispute that this gigantic and repulsive tree has intrigued virtually every visitor to the parts of Africa where it grows.

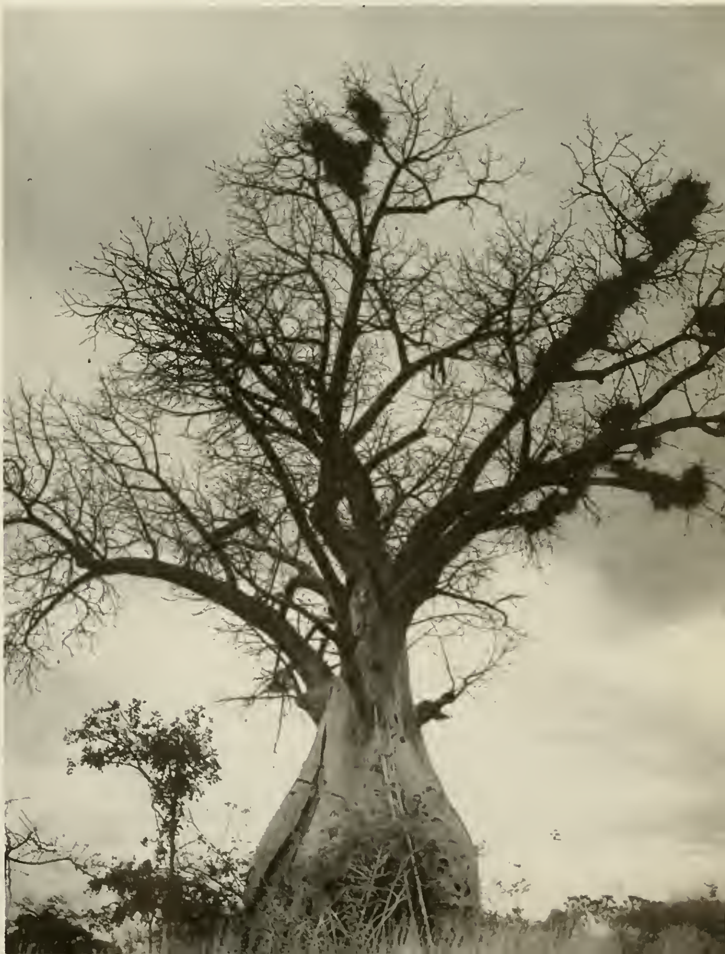
It is known by many names, among them Monkey-Bread, Calabash, Ethiopian Sour-Gourd, and Cream-of-Tartar Tree. The Swahili call it *mbuyu,* while in certain sections of South Africa it bears the name *moana* and in more northern section *kuka* and *tebeldi.* Witch doctors in East Africa have their own designation for it—*mkuu hapingwa.* It is generally considered a member of the silk-cotton family (Bombacaceae), and its technical



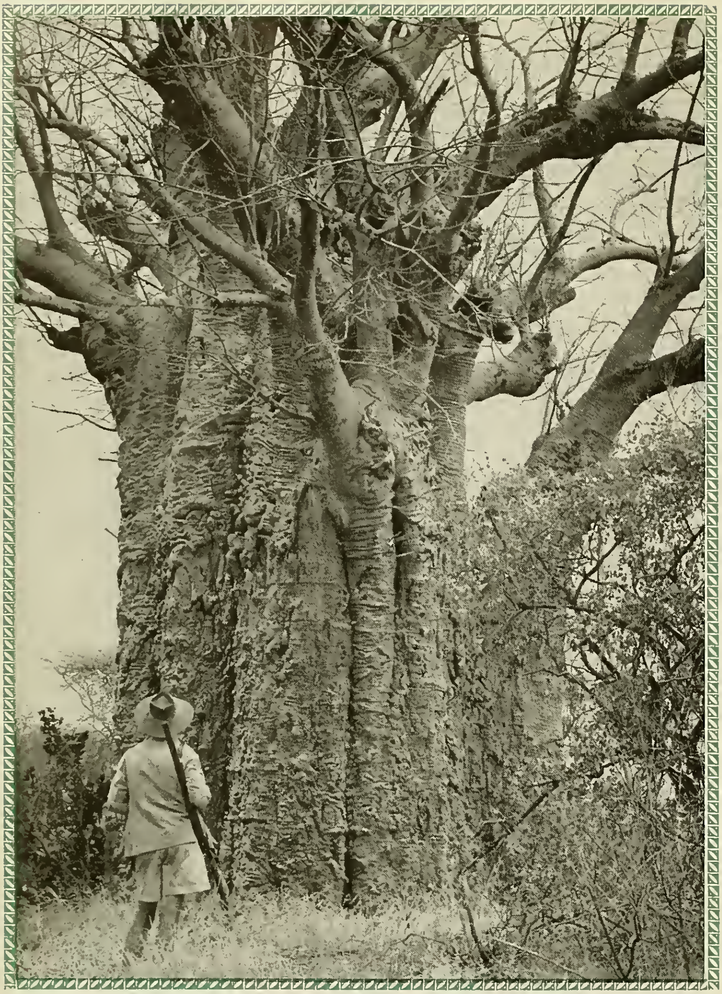
➤ Drumlike bee tubs, such as the one in the upper left part of this tree, are usually hung in the towering baobabs and are inspected regularly

◄ This old-type Kikuyu carries a hollowed section of a log trimmed with baboon hide in which to collect honey from his bee tubs in the baobabs

▼ The Bottle Baobab is peculiar to certain sections of Africa. The ladder leaning against this one leads to the loglike native beehive seen among the lower branches on the left. Above are nests of the gregarious weaverbird



▼ The author's baobab-inspecting scout car stops near a bottle baobab. The bark of this one had the exact texture and color of elephant hide



▲ "CREAM-OF-TARTAR" TREES, as the baobabs are called because parts of them are used in flavoring food, grow to tremendous size on Zanzibar. This one is 72 feet around. Many have hollows inside their trunks, and on the mainland some tribes make use of the water accumulating there. Others place their dead in them

name, *Adansonia digitata,* came from the celebrated French explorer, Adanson, who roamed Senegal about 1750.

The baobab usually grows to only a moderate height, but it has a ponderous girth out of all proportion, so that it resembles a monster toadstool with a tiny cap when in leaf. When naked, its gnarled branches with pendulous fruit are reminiscent of the tortured souls transformed into trees in Doré's illustrations for Dante's *Inferno.* There is a leprous look about its dirty-pink, glabrous bark and massive trunk, swollen like the limbs of a victim of elephantiasis. The digitate leaves, similar to those of the horse chestnut, remain on the tree approximately five months.

Big trees are probably impressive because of their ability to make man feel his own relative unimportance. The redwoods of California, towering majestically into the heavens, are genial giants, and with the soft light filtering down between their aisles they invariably remind people of a holy cathedral.

Not so the baobab.

It stands stark and defiant, almost menacing with its brooding bulk; and to those of us familiar with northern woodlands, an intangible aura of unnaturalness hovers over the somber monster.

Its unusual appearance undoubtedly accounts for the widespread native superstition that the tree is inhabited by evil spirits—a belief that may explain the witch doctor's name for it. No tribesman has ever been able to explain satisfactorily the meaning of *mkuu hapingwa* to me, and in consequence I have had to play detective in an attempt to solve its derivation. The prefix *mkuu* is Kiswahili for "big" or "preeminent," while *pingwa* is the passive form of the verb *pinga,* which means "to block or thwart." By their appellation the juju men may thus signify that the powerful demons dwelling within the baobabs counteract their own medicine-making —a handy alibi when their wizardry miscarries. More learned students of Kiswahili than I may be able to shed light on some other obscure or esoteric meaning.

Regardless of its exact meaning, however, the fact remains that many a simple African regards the baobab with such dread that he will avoid passing near one when dusk creeps across the veldt. The Wakamba used to propitiate the great tree with offerings, much as ancient Egyptians honored the Sacred Sycamore, *nûhît rîsit,* which they worshipped as a symbol of Hâthor.

The soft, spongy wood of the baobab has no resistance to a modern bullet, and a 30-06 solid will completely penetrate the largest of them. Travelers who noted this wrote the tree off as a bizarre but useless tree, yet for all its malignant appearance there are few growths in nature as bountiful.

During the rainy season its knotted hollows preserve water, which can be found weeks and even months after the dry weather has set in. In some sections of Western Kordofan this forms the native's chief source of the precious fluid. Pith hacked out from beneath the tough bark can be wrung out like a dishcloth to yield moisture, much like the barrel cactus of our own Southwest, and it has saved more than one trekker of the parched *nyika* wastes when his canteen went dry.

The flower, a waxy bloom that tarnishes rapidly, is sometimes crushed with sugar and water to make a refreshing and unusual beverage, and the seeds yield a valuable oil. The rind of the pods can be chopped and mixed with milk or water to make a bitter-tasting although nourishing biscuit. The subacid farinaceous pulp surrounding the pips is crushed and ground into a powder used for flavoring food, hence the name "Cream-of-Tartar Tree." Mixed with water, this substance forms a lemonade-like liquid esteemed by some as a febrifuge in combating malaria.

Along the coast near Mombasa the Giriama women, in preparing their elaborate coiffeurs, first soak their hair in a baobab-seed solution, followed by a lime-juice rinse.

The fibrous bark of this remarkable tree furnishes material for cloth and rope, and in the days of muzzle-loading guns the hunters cut off squares of bark to obtain the inner fiber for use as wadding. Experienced sportsmen on safari usually head for the scant but welcome shade of the baobab when ready to set up their base camp. When Kermit Roosevelt journeyed to the Shimba Hills of Kenya in quest of sable antelope, he camped by choice under such a tree, but not for long. His boys had inadvertently pitched the tents over a subterranean ant kingdom.

The bark of the baobab has the texture of cast cement and is a sooty gray with pink or purplish overtones. Since this is exactly the color of an elephant, many a veteran of the Ivory Trail has swung a rifle at one when emerging suddenly from dense bush. William Oswell himself sheepishly admitted having done so. Sometimes multiple trunks weld themselves together to create a massive fortress-like bole, and in certain sections the trunk simulates the general shape of a beer bottle. In Rhodesia and on Kenya's northern frontier there are many such bottle baobabs.

Sir Richard Burton, trained observer that he was, noticed 90 years ago that these big trees were not all alike. He was the first writer who alluded to the baobab as *mbuyu* ("bucket"), which derives from the Swahili custom of making water buckets from the seed pods by cutting slits in the upper section of the acorn-shaped pod and lowering it down into the well with a cord of plaited palm leaf. Along the coast these baobab buckets used to be seen frequently hanging outside the huts. The seed vessels hang perpendicularly from the branches on stringlike stalks and for a time are covered with thin gray plush.

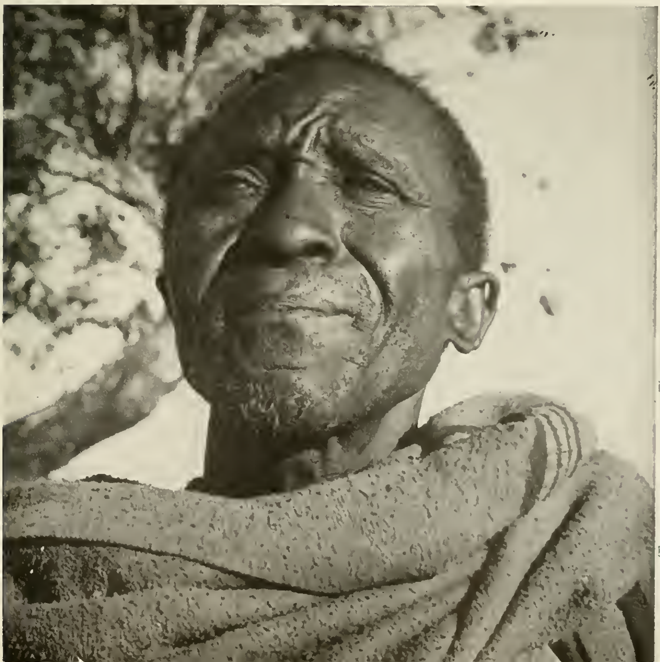
Most hollow trees become dead or rotten inside after a while. It was David Livingstone, a keen naturalist as well as missionary, who discovered that baobabs were different in this respect. In his journal *Expedition to the Zambesi,* he declared that a hollow baobab, though stripped of its bark outside, had the power to grow new bark on both inner and outer surfaces.

The giant trees fascinated this gentle man, and he came across what must have been one of the largest of them while in Makolo country. His original letter, which was written to his brother Charles in 1853, is preserved in the Scottish National Memorial at Blantyre. Here is what it says:

"I am standing under a Moana or Baobab tree composed of six branches rising from one root and joined together until about five feet from the ground. At three feet from the ground it is 85 feet in circumference and is at least 60 feet high. The reddish color makes it look more like a mass of red granite than a tree. The branches high above look like what I have hitherto called large trees. The wood is quite soft and spongy."

It is under a giant baobab in lonely Shuhanga, on the banks of his beloved Zambesi, that Livingstone's devoted wife, Mary, lies buried.

Baobabs have always been fa-



◄ THE WAKAMBA were formerly cannibals, yet you couldn't bribe this oldster to go near a baobab after dark. He's squeamish about spooks vored by the less superstitious tribes as racks on which to suspend their drumlike bee tubs, and they drive pegs into the pulpy wood of the trunk in order to reach the higher branches. It isn't solely a sweet tooth that occasions such industry, however. From chunks of fermented comb the natives make a sort of mead, on which they get as intoxicated as they did from the square-face bottles of gin once peddled by unscrupulous traders.

What is probably the cleverest description of the big tree without foliage was penned at the turn of the century by a hunter named Ansorge. "With its aldermanic girth," he wrote, "when it has shed its leaves it stands bare and gaunt and looks as if stretching out gouty fingers in apoplectic uncertainty."

The grotesque tree has always interested scribblers, and in Mombasa they tell the story of how it was once misnamed by a lady journalist visiting briefly from a cruise ship. Being interested in plant life, she hired a native boy to guide her about. Unfortunately he was a *shenzi,* an upcountry boy to whom all such things were blanketed as *miti*—just 'ol trees. The lady had learned only a single word of Kiswahili, *jina,* which means "name," and hoped naively that this would suffice in identifying various trees. In her peregrinations with her not-too-bright escort she happened upon a baobab and was entranced by its formidable size. Pointing to it she asked *"Jina?"* to which the native, looking blank, laconically replied *"Sijui"* (I do not know). When the glowing description of her exploits was published, it said: "The most interesting natural wonder on the island of Mombasa is a huge tree which is tall and thick, the trunk being almost as wide as a small house. It is called a *Sijui* tree."

The showers of light rain that usually fall in November cause the varied flora to burst into leaf and bloom as if by magic, and it is then that the grim baobab bedecks itself in frivolous finery. There seems to be some variation in the color of the flowers. I have seen white flowers with yellow centers, and R. C. F. Maugham reports the same coloration in his book *Portuguese East Africa.* However, Dr. Peter Bally, a botanist at the Coryndon Museum at Nairobi, informs us that in all the parts of East Africa where he has seen the tree in bloom, the color is white, turning slightly ivory-yellow and then brown as the flower fades. He also speaks of a pale mauve flower that is said to occur in West Africa, but I know nothing of this. The flowers measure as much as six inches and have massive staminal columns. With its bloated trunk and gnarled arms, the tree somehow achieves the general effect of a fat and aged actress, disguised with hair ribbon and pigtails, attempting to play a teen-age schoolgirl.

It wouldn't be fair to ridicule the fabulous tree without mentioning that it has also had its share of deeds of derring-do. On Zanzibar and its sister island, Pemba, the baobab grows to tremendous size. Pemba, a remote island where tribal witch doctors once learned their grisly trade, was reputedly selected by the swaggering Captain Kidd as a repository for his loot. For markers it was natural that he would choose baobabs because of their longevity. Within the memory of living man old natives have told tales they heard from their fathers, stories of long boats rowed to shore in the black of night. The European visitors proceeded by torchlight to a giant baobab deep in the jungle, on which a cross had been cut long before. Digging at the foot of the tree the stealthy searchers unearthed a heavy brass-bound chest full of treasures.

Another version says it was a huge silver bowl or covered dish heaped with coins, which from the description might have been doubloons or ducatoons. Burton corroborated the story when he wrote of Pemba.

"In A.D. 1698," he stated, "Captain Kidd here buried his blood-stained hoard of gold and jewels, the plunder of India and the further Orient. The people have found pots of nuggets."

It is not strange that young baobabs should be considered a mystery in some sections. Young trees are so few and far between that the Mombasa Rowing Club used to visit a spot across the creek from Peleleza for the express purpose of viewing one. They reported that in several decades the tree, a sapling, never seemed to grow an inch or alter in any way.

My good friend Commander David Blunt, whose book *Elephant* is still standard reading for tusker-trackers, told me that in his long years in the bush he had seen only five small baobabs, despite a lengthy period spent roaming the Matandu River Valley where the big trees were extremely numerous.

I had crossed Africa on safari twice before I ever saw a small one, and then I got into a patch of bush where baobabs grew in profusion. I had been on the bleak Barotse Cattle Cordon in Northern Rhodesia, and to save wear-and-tear on the axles of my safari cars I loaded them aboard a flatcar on the Zambesi Sawmill Railway to get them out of the wilderness. Rattling through the woods, accompanied by a cargo of Rhodesian teak and a motley collection of Thongas, Barotses, and Mashukulumbwi boys, I suddenly began seeing baobabs of all sizes around us, including trees as small as ten and even eight inches in diameter. It is the only place in Africa where I have ever seen any, and I suppose I should have signaled the engineer to halt while I leaped off and had a documentary photograph taken of myself triumphantly clutching one of the midget trees. I didn't, though. All I wanted was to get out of that tsetse-ridden Barotse country as fast as possible.

Many settlers, remote from botanical libraries, tried to solve the mystery of the absence of young baobabs, and 40 years ago one of them thought he had done so. He was Mr. J. E. Hughes, a Cambridge scholar turned big-game hunter, and his adventure happened on the Muchinga Escarpment in Northern Rhodesia. In that section the local name for baobab is *mlambi;* and one day while out with a native tracker, Hughes tripped over a thick creeper lying across the path. His ebony-hued companion prodded the thing with his spear and said "*Mlambi ulya,*" which means "a baobab." Startled, the hunter questioned him and was told that among this particular tribe it was common knowledge, handed down from generation to generation, that baobabs started life as such a creeper.

Being intensely interested in the old legend, he examined the repulsive-looking vine, which was about fifteen feet in length and growing along the ground. The native pointed out that it was making its way toward an adjacent large tree. The creeper was round, without branch or leaf and covered with the same purplish-gray bark as big baobabs. According to his African informant, the creeper would slowly coil like a python around the big tree. It would then gradually engulf and absorb it and expand outward like some obese glutton. Today we know that he was wrong.

There are one or two odd things about the baobab that I have noticed. For instance, I've seen good-sized ones half-uprooted and pushed over to a 45-degree angle but still growing merrily despite the new slant. On the Great North Road in Rhodesia, not far above Beitbridge, one suddenly encounters "melted" baobabs. These big trees have crumpled to the ground like a stocking betrayed by a faulty garter. Whether this eventually happens to all old ones, I am not prepared to say. I suspect instead that this is the work of a fungus that is believed to attack the species, reducing the supporting fibers to a pulpy pith without strength. It is a shocking thing to realize that the sodden heaps of squashed papier-mâche were once colossal, rocklike baobabs.

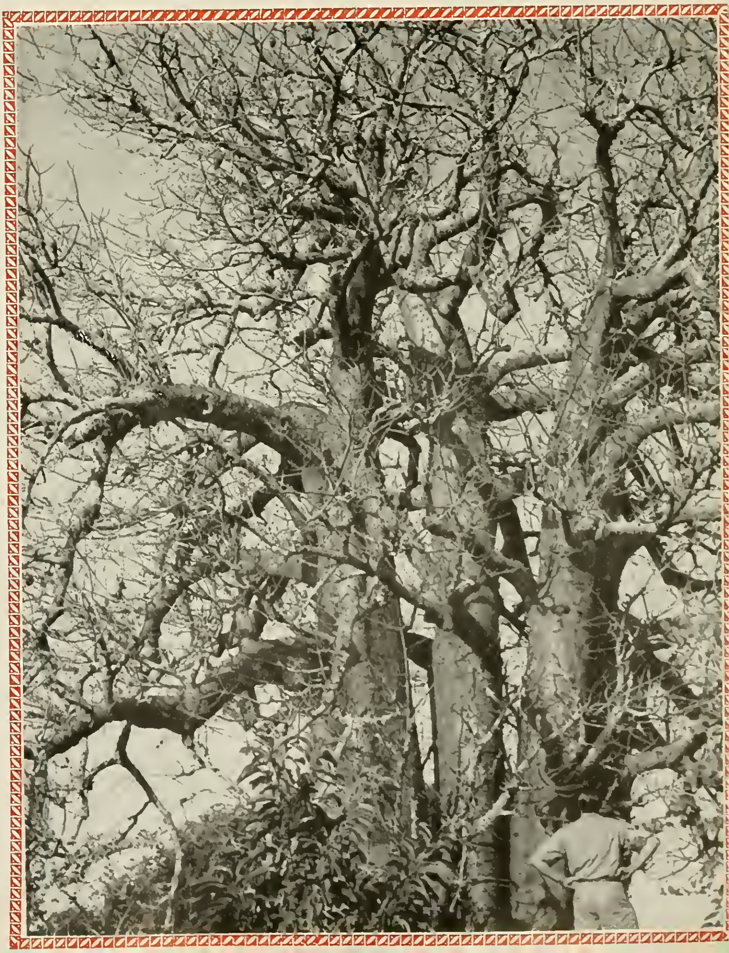
On the west coast of Africa, these great trees are found as far south as Southern Angola and as far north as Senegal, but there are no baobabs in the intervening Congo region. Near the Gold Coast the natives once used the hollow trunks as grave vaults, hanging their dead inside them. In contrast to its sinister reputation in many of the Bantu-speaking areas, the tree is venerated in the Blue Nile Province of the Sudan (where it is called *tebeldi*). Each baobab has an individual title, which is always respectfully prefixed with *um,* which means "mother."

The most northern member of this mighty tree is reputed to grow in the Palace gardens at Khartoum, where it was planted by the explorer Schweinfurth. This fact alone should have indicated the existence of young trees, since it is unlikely that anyone would have undertaken to transplant a very large specimen. This is near the northernmost range of the tree.

Today Africa is fast becoming civilized, and even back-country tribesmen are donning the clothes of the white man to learn the trade of butcher, baker, or candlestick maker. The stabbing assegai and oxhide shield of the fierce Zulu gathers dust along with the painted buffalo-hide shield and lion spear of the arrogant Masai. Ice cream soda emporiums are appearing now, and skyscrapers rise ever higher in the swank city of Johannesburg, while familiar Fords, Chevvies, and Jeeps whizz by on smooth-surfaced roads.

The old order changeth, unfortunately, but the inscrutable baobab pays no heed. Ignoring the passing centuries, it just goes on and on and on as if determined to prove that it holds the secret sought by Ponce de Leon.

▼ **Multiple trunks** often grow from a single stem, and the resulting tangle looks like a Chinese puzzle



▲ A SNOW TURN ON TEMPO DOME. A skier is in his element on the snowy slopes of the Badger Pass Ski Area in Yosemite National Park

WINTER

throug

True nature lovers find in winter
a fresh challenge for their
outdoor activities

By JOSEF MUENCH

◀ WINTER PAGEANT. Beautiful as they are in summer, the splendid forests of Sequoia National Park take on a breathless grandeur when snow weighs down the branches with white. Rolling drifts hem in the seedlings in the meadows, making tiny mannikins of them

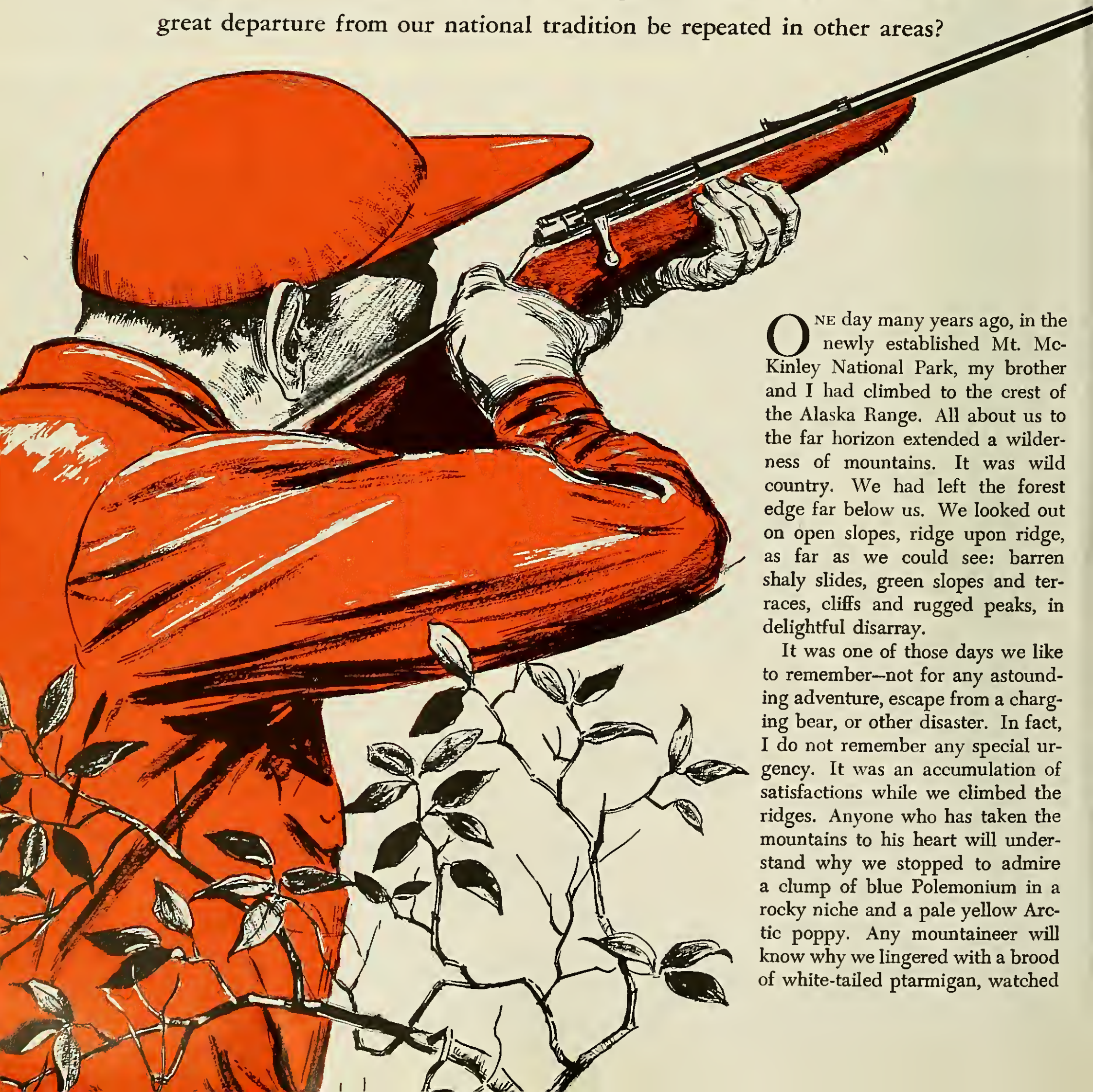
➤ MT. SUPERIOR, at Alta, Utah. Like a holiday greeting card come to life, the wintry landscape combines white mountain slopes, trees bedecked with powder-puff decorations, and snow-covered ski huts

e Camera's Eye

➤ YOSEMITE'S HALF DOME. Framed by sleet-covered branches, the famous landmark seems hardly touched by the winter force that grips the valley below

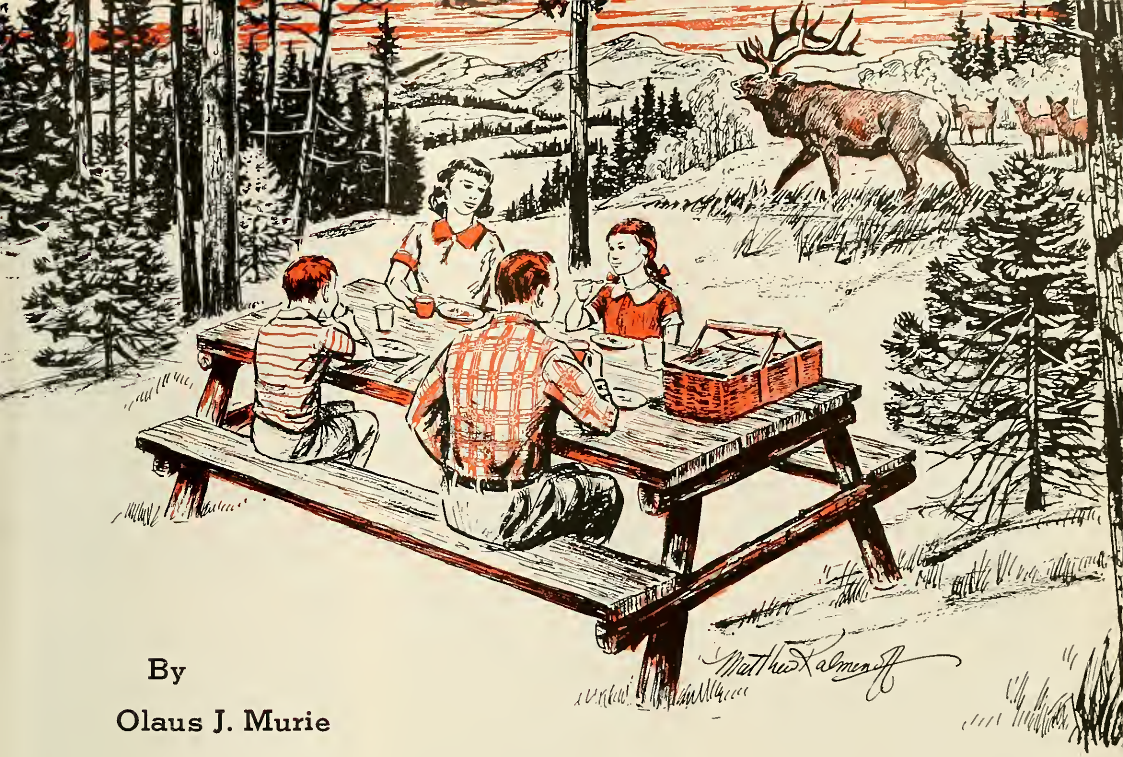
Do You Want Hunting in National Parks?

Most people did not know that a Congressional Bill was passed in 1950 breaking the inviolable rule against hunting in National Parks. Will this great departure from our national tradition be repeated in other areas?



One day many years ago, in the newly established Mt. McKinley National Park, my brother and I had climbed to the crest of the Alaska Range. All about us to the far horizon extended a wilderness of mountains. It was wild country. We had left the forest edge far below us. We looked out on open slopes, ridge upon ridge, as far as we could see: barren shaly slides, green slopes and terraces, cliffs and rugged peaks, in delightful disarray.

It was one of those days we like to remember—not for any astounding adventure, escape from a charging bear, or other disaster. In fact, I do not remember any special urgency. It was an accumulation of satisfactions while we climbed the ridges. Anyone who has taken the mountains to his heart will understand why we stopped to admire a clump of blue Polemonium in a rocky niche and a pale yellow Arctic poppy. Any mountaineer will know why we lingered with a brood of white-tailed ptarmigan, watched



By

Olaus J. Murie

them picking at the sparse vegetation. These are the true mountain grouse, braving the rigors of the highest places, as high as the vegetation will grow. White mountain sheep were all about us, dotting the green slopes as they had been doing since the glacial age. We saw the wheatear on these heights and the snow bunting, and we were alert for any chance grizzly. We knew there were foxes in these mountains, and we saw the deeply worn migration trails of caribou. A golden eagle was soaring high over the divide.

We had hunted mountain sheep in other parts of Alaska; we had shot caribou for meat and for museum specimens. But here in the highlands that had been declared a National Park, we had no desire to hunt. We sat down on a ridge and looked over a band of mountain sheep with our glasses. It didn't occur to us that we ought to have a gun. Here we were not looking at game animals. These creatures were part of a fascinating assemblage of animal life that was the product of the complex forces that shaped these mountains. The soil, climate, and the ecological influences had apportioned these animals and plants to their chosen living places and set them upon their various destinies. This area, by its special dedication, was no longer merely a hunting field. It had become a place for reflection and study, a place for wonderment and inspiration, a place where human beings, pursuing their own obscure and confused destiny, might come for refreshment of spirit and clarity of thought.

I believe it is significant that the man whose enthusiasm had so much to do with the establishment of this park was Charles Sheldon, a combination of hunter and naturalist. Moreover, the first superintendent of the park was H. P. Karstens, a woodsman and hunter who had been Sheldon's capable guide and friend and who had guided the first ascent of Denali. As superintendent he was as zealous in furthering complete protection of wildlife in the new park as he had been successful in hunting elsewhere.

These two men were big enough to distinguish one purpose from another, broad enough in interests to realize more than a single value in the out-of-doors. They were happy to give sanctuary to wildlife in chosen areas devoted to a policy different from the general one of hunting. Thus it came about that hunting became unconditionally prohibited within the boundaries that delineate Mt. McKinley National Park.

This policy has been an integral part of the National Park Service since it was established. It has been accepted and understood. The millions of people who visit the Parks each year do so without apprehension. Everyone else there, like themselves, is interested in enjoying the majesty of the natural world, and they roam the trails without fear of being mistaken for a grizzly by a man who wants to kill grizzlies.

But in recent years there have

been some threats to this policy. An occasional resolution, requesting hunting in National Parks, has emerged from sportsmen's groups. None of these requests, however, succeeded in altering the law until 1950, when Public Law 787 became effective.

In northwestern Wyoming lies a valley that had become notorious for a long-feuding controversy—the location of Grand Teton National Park and the Jackson Hole National Monument. This valley and its bordering mountains has as fair an aspect of natural loveliness as any place one can find. Here mankind can come to free the mind of entangling conflicts that corrode judgment; a place of wild slopes leading upward to heights of grandeur, to lofty displays of wildflowers, to the rare atmosphere of the domain of the rosy finch, the cony, and the brilliant red primrose. Up some of the canyons you come across an occasional moose. If you are lucky, you may see a marten along the trail or in the slide-rock.

In the valley itself you see a stimulating sweep of country — broad, flat sagelands where pronghorn and bison once came to graze in summer. At the series of lakes along the base of the mountains, moose wallow around, ducking for aquatic plants. Beaver are here and yellow pond lilies.

Here again Nature had provided a superlative spot for the enrichment of human lives. And here had centered the human argument over the spoils.

Public Law 787 was designed to settle this fight, by combining the two designated areas into one enlarged Grand Teton National Park. This was a credit to the sponsoring Wyoming Senators and to the people of Wyoming who were willing to come to agreement.

But the law contains a provision that, should it become necessary to reduce the elk herd, or at least that portion of it that migrates across certain Park lands, some shooting could be authorized within Park boundaries by persons holding a state hunting license, if deputized as temporary rangers.

It was obvious that Senators O'Mahoney and Hunt, who prepared the bill, did not wish to have this construed as a precedent for hunting in National Parks, and they said as much.

Many were concerned over the provision, however. A legislator may declare his intention that an act shall not be a precedent. But precedents are not necessarily created or prevented by fiat. They become precedents in the minds of people. Apparently that is what happened. No sooner had this act passed Congress than a spokesman for the Colorado Game Department expressed the hopeful opinion that it might lead to opening National Parks to hunting. Articles to the same effect began to appear in certain sportsmen's magazines. Some people in western Washington began agitation for hunting in Olympic National Park.

We are here faced with procedures that have crept into our method of establishing policy. If our way of life shall rest on justice, we cannot ignore certain dangers arising out of our own imperfect natures. As a people, we still countenance the filibuster and the rider on bills in Congress. In the case of Public Law 787, we have an instance of certain individuals taking advantage of the wording of a bill, contrary to the known objective of that bill. Whatever the merit of hunting in National Parks, such a change in long-established public policy should never be accomplished by indirection, on the tail of a piece of legislation designed for other purposes. It should not be accomplished by clever manipulation or by high pressure means that don't allow the interested public to realize fully what is implied.

We should examine this, or any other question, from the standpoint of the government system in which we profess to believe. Perhaps what we need today is to redefine this system. Perhaps it is allied to sportsmanship at its best. Perhaps it is allied to simple consideration and honesty.

Let us say that in the matter of hunting in National Parks, there are two groups of citizens interested, pro and con. Suppose that the decision goes in such a way that one group is given complete satisfaction, the other group loses completely and retains *no* area in which conditions remain as they wish them. In other words, the winner takes all, the loser gets nothing.

Now suppose the decision goes in such a way that both groups get their respective policies applied to different territories. In other words, neither group loses. Both groups share.

Which of the decisions would seem to harmonize with the spirit of the system we profess to believe in? Which is in line with the sportsmanship that the hunting fraternity professes to support? Which is *just?*

It is worth giving our attention to this principle. Let's see how it works out. As it concerns the animal life, there are two types of country owned by all the people. If for the present study we simplify the matter, let us say that these consist of National Forests and public domain on the one hand, and National Parks and National Monuments on the other. The first category is open to hunting, the second is not.

Now compare the extent of these two categories. The National Parks and Monuments are a minute fraction of the remaining public land. What would it be? A fraction of one per cent? Two per cent? I do not know, but certainly it is small. In other words, hunters have the opportunity to shoot practically all over the North American continent, in every state of the Union, including Alaska; on public and on much of the private land.

Here are some of the other advantages given to the shooters. A federal bureau, supported by all the taxpayers at tremendous expense, maintains a great system of wildlife refuges to counteract the killing of wildlife by shooters. The major research of this bureau is applied directly or indirectly to management of game, of special benefit to the sportsmen. Only recently, this bureau has inaugurated a program of scouring the world to find exotic species of game birds to put into the American countryside as targets for sportsmen. The nonshooters had nothing to say about this, were not asked, though many of them would have had strong opinions on the matter.

Each state has some form of Game Commission whose sole aim is to maintain game for shooters. These commissions are supported by the shooters, and all land use and wildlife management under the commission's jurisdiction is directed primarily in the interest of the shooter. Nonshooters are almost invariably barred from participation in the administration of wildlife, though theoretically the wildlife belongs to all.

Furthermore, practically all other public agencies having to do with public land use spend considerable time on the matter of game production. I am not intimating that we should not have the federal bureaus or the game commissions. They should have our support. But in view of all this, can it be said that the shooters of America are not getting their full share of wildlife use? It is hard to understand how certain organized groups can, with a conscience, demand entry as shooters into the few land parcels dedicated to a different purpose.

This is not a brief against hunting and fishing. Nor should it be implied that all shooters are unfair. A great many supporters of the National Park policy buy hunting and fishing licenses. I have cited Charles Sheldon as a high type of sportsman who had an eye for the total public good. The late Stewart Edward White was another. The Boone and Crockett Club sponsors a system of evaluating sportsmen's trophies. But they have also undertaken to restore the desert bighorn in Big Bend National Park of Texas. It is this kind of vision and broad interest that will help to keep our field sports from degenerating into mere sadism. It will be such men who will help keep our government system from degenerating into a mere free-for-all.

Let us refer briefly to the situation on the Olympic Peninsula. Here is a National Park of the highest caliber. The virgin timber of the coastal region of Washington will, of course, disappear as lumber. When the virgin timberlands have been exhausted, the glory of the Olympic Park forest will shine with greater significance. It will then be all the more a treasure because of the scarcity of such natural forest.

If sportsmen of the Olympic Peninsula want more elk, they would do well to explore the possibility of re-establishing more extensive herds in the cut-over lowlands outside the National Park, where browse is abundant. Elk transplants are entirely feasible if attention is given to biological principles, migration habits, homing instincts, and the over-all pattern of elk behavior.

If such a program could be authorized to promote the restoration of game for the sportsman in surrounding National Forest areas—a program, co-operating with the National Park Service in its program of complete sanctuary within Park boundaries—, a harmonious situation would be created. Shooters could then have their sport in accessible areas outside, on National Forest or private lands, in areas as extensive as the wildlife authorities care to make them. And in addition to their sport, the shooters could, if they chose, join the nonshooters in the enjoyment of the unchanged wilderness of a superlative National Park, with cameras instead of firearms, or simply with the purpose of seeking the inspiration inherent in the grandeur of a mighty forest and mountain terrain. We must ever remember that when we are through taking the original "cream" of our timber supply, there will never again be the giant tree growth that is being saved in our Parks. Forest cropland policy would never permit the giant growths we now have.

Within the forest fastness of this great Park, the cougar and bobcat, persecuted elsewhere, may be given this limited chance to survive. The cougar is disappearing from the American scene. Being the counterpart of the lion in Kruger National Park of Africa, it, too, eventually will be valued as the primeval heritage of a continent. The blacktail deer, the Roosevelt elk, the fisher (if any remain), the blue grouse, mountain beaver, the irrepressible winter wren, and the varied thrush are all associated with that typical coastal forest of hemlock, fir, and spruce. Evening grosbeaks in the vine maples, a black bear on a high trail; sunlight filtering through the massive trees of the deep forest, the free openness of the high meadows, a climb on the central mountain; and over all of it the breath-taking wildness.

This is what a National Park has to offer. This is a unit we have inherited, and its value increases with each generation. We must tamper with it as little as possible.

It would seem worthy of mankind, historically so cruel in many ways, to here permit himself the luxury of generosity, by providing sanctuary for at least a remnant of persecuted animals. This is a noble gesture that man can make—a truce with our wildlife neighbors on a few selected pieces of neutral ground.

This is the feeling that moves people who support our National Park system and its wildlife policy. They have satisfaction from the knowledge that here, in a National Park, animals are permitted to live their lives with the least possible interference by man.

The Perfect Parasite—THE VIRUS

Important progress in human medicine may result from investigation of the agencies causing tumors in plants

By Joseph Bernstein

IT is in the autumn that the disease usually strikes. During the long drowsy days of summer the sleek hogs have been contentedly fattening themselves and seem to be in sound health. But with the yellowing of the leaves and the first chill winds of fall, some of the animals become listless and no longer dine so heartily. Their temperature rises, and the farmer listens anxiously to their labored breathing. A day or so later, many of the beasts are stretched out stiff in death, victims of swine influenza.

As happens so often in the history of science, a search for one thing led to another. The bizarre chain of relationships that culminates in swine influenza was unmasked only as a result of an investigation into hog cholera. Back in the late 1930's, Dr. Richard E. Shope, who was then working at the Rockefeller Institute for Medical Research at Princeton, New Jersey, was trying to find the intermediate host that transmitted the virus responsible for hog cholera. He had heard of a popular belief among the farmers in the Middle West that the outbreaks of hog cholera had something to do with the hogs eating earthworms.

Now earthworms are also the hosts for certain tiny juvenile roundworms that spend their mature lives in the lungs of swine. And the inspiration struck Dr. Shope that these little lungworms might provide the basic clue to hog cholera. Later events showed this hope to be unfounded. But through a series of highly ingenious experiments, Dr. Shope succeeded in unraveling the mystery of swine influenza.

The swine lungworm lives a double life, which seems most peculiar to anyone who doesn't know parasitic worms. Its early stages are spent in the calciferous glands and other organs of the earthworm, and the rest of its existence in the bodies of pigs. The goal of every young lungworm is the lungs of these animals. One might think, therefore, that the natural and easy thing for it to do would be to proceed directly to these organs. This, however, the lungworm does not do. To reach its destination it travels through a fantastically circuitous route.

The journey actually begins in the lungs of the pig, where the adult female lungworms have deposited their eggs. These are coughed up, swallowed, and passed down the digestive tract, finally being eliminated into the soil. There the eggs are swallowed by earthworms and hatch into larvae, which find their way to the worm's heart, gizzard, and calciferous glands. Within the earthworm they molt twice and thus become "third-stage" young. Only at this stage can they infect pigs. And they can survive in this form inside an earthworm for as long as four years before being swallowed by a pig and continuing their life cycle. But swine are rather fond of earthworms, and the chance of getting

▲ Tumors on a sweet clover plant. On
tumor may be seen on the lowest branch or
the right where it rubbed against the edg

into the digestive tract of one of them is very good.

Once liberated in the hog's intestines, the larvae bore through the intestinal wall and proceed to the lungs, where they at last mature into adults.

There is an ancient jingle that runs as follows:

> "Great fleas have little fleas upon
> their backs to bite 'em.
> And little fleas have lesser fleas,
> And so ad infinitum."

While the author of this profound maxim of parasitology probably never heard of swine influenza, he put his finger on the basic clue to this disease. For the truth of the matter is that the lungworm, which so ingeniously uses the earthworm to "hitchhike" into the vitals of the hog, is itself invaded by a "lesser flea," so to speak, which also has the same destination. The lungworm harbors and transports the virus responsible for swine influenza.

But this virus is in a quiescent, masked stage in the lungworm. It is provoked into infective activity in swine only when these animals are exposed to various types of stress, such as the presence of other microorganisms.

So extremely small is this virus that it cannot be seen with the ordinary microscope. It passes with ease through the finest filters that can prevent the passage of bacteria. But photographs of it have recently been made through the electron microscope, and it seems to have a fascinating variety of shapes. The images range in form from circular to oval and elliptical. Many even have a beanlike appearance, and on occasion they become filaments.

Just what this bewildering confusion of shapes may mean is anybody's guess for the present. Perhaps they represent different stages of an elaborate cycle of development such as occurs among organisms higher up in the scale of life.

Of course, we cannot attribute wisdom and knowledge to something as primitive as a virus. But there can be no question that the swine influenza virus thrives by virtue of the fact that hogs feed on earthworms and that lungworms parasitize both hogs and earthworms.

But a virus does not necessarily have to utilize only animal agents to achieve its goal of self-perpetuation. This becomes spectacularly apparent in the strange relationships involved in the origin of certain abnormal growths in plants.

Photo by Julian Carlile

of the pot. A virus is the actual cause of the tumors, but an insect known as a leaf hopper conveys the virus to the plant. Every effort to inoculate the plant with the virus artificially has failed; only the leaf hopper can do it

Photo by Julian Carlile

▲ **An enlarged** photograph of the leaf hopper *Agallia constricta*—one of the kinds that transmit wound-tumor virus

Anyone walking through a meadow or field has undoubtedly seen certain small squat, triangular insects popping explosively about in grass and foliage. They are most appropriately called leaf hoppers, and their agile leaping from plant to plant is associated with the serious business of getting a living. The mouth parts of these insects are slender, jointed beaks—admirably suited to the job of piercing the plant's tissues and sucking the

Brooklyn Botanic Garden photo

▲ **Dr. L. M. Black** working on the wound-tumor problem in the greenhouse at the Brooklyn Botanic Garden

▼ **Although only the leaf hopper** can infect the plant, a laboratory technician can convey the virus from a diseased plant into the insect's body and make it thus a carrier. This picture shows that process. After an incubation period of two or more weeks, the insect will be able to infect healthy plants

juices, which make up the leaf hopper's diet.

But leaf hoppers do not confine their activity to the relatively innocent one of extracting a small amount of juice from a plant. The plant can well spare the infinitesimal amount of sap taken by this insect. Certain leaf hoppers have another role to play—an involuntary one from which they derive no benefit.

For a few weeks after visits of these particular leaf hoppers, nothing is seemingly wrong with the plants. Then a most peculiar transformation takes place. Depending on the species, tumors of various sizes may appear on the roots and stem. The veins on the undersides of the leaves may become enlarged in an irregular fashion; the leaves may curl, the stem thicken, and flowering may be suppressed. The growth of the entire plant may be stunted. The plant looks and is quite sick.

Although exhaustive efforts have been made to detect it, no one has yet seen the agent responsible for this disease. Not even the powerful electron microscope in the hands of a leading worker in this field, Dr. R. W. G. Wyckoff, has given any inkling as to its appearance. On one thing there is complete agreement, however—the causal agent is a virus.

Known as the wound-tumor virus, it was first discovered by Dr. L. M. Black in 1944 at the Rockefeller Institute for Medical Research, Princeton, New Jersey. It is right now still under intensive study by Dr. Black and his associates, Dr. M. K. Brakke and Dr. L. G. Nickell, at the Brooklyn Botanic Garden.

While the wound-tumor virus can infect a large variety of plants, the investigators at the Brooklyn Botanic Garden have been studying its effects on two lowly plants, sweet clover and sorrel. These plants are of little economic importance and do not have any aesthetic features that might distinguish them. Sweet clover, as a matter of fact, is often annoyingly common in fields and neglected gardens. But both plants can be grown with great ease and convenience under laboratory conditions and have the added value of responding to the virus by producing conspicuous tumors on the stems and roots.

One of the mysterious things that was early discovered about the wound-tumor virus was its fastidious insistence on being introduced into the plant in a certain manner. Like practically all leaf hopper-borne viruses, it must find its way into the plant's tissues by means of the mouth parts of a specific insect. No other way will do.

All sorts of tricks have been tried to circumvent this peculiar insistence of the virus on leaf hopper transport, but all have failed. For example, you just can't mash up a number of infected leaf hoppers, inject the mixture into healthy plants, and expect to get tumors on the stems and roots.

Nor can you inject the sap from diseased plants into uninfected specimens and produce the disease. It is true that most other plant virus infections can be caused this way—but not wound-tumor. As a matter of fact, diseased and healthy plants can be grown together, side by side, and if leaf hoppers are not around, the healthy plants will not develop tumors.

But the picture is strikingly different when it comes to infecting the leaf hopper. A fine glass tube containing some of the juice from a diseased plant will readily introduce the virus into the insect's

➤ **Dr. L. M. Black** uses a fine glass tube to inject into the insect's body some of the juice from a diseased plant. There the virus particles will increase in number. Healthy plants can grow unharmed beside unhealthy ones if the leaf hopper is not present

Photo M. Bassity

Photo M. Bassity

body. There the virus particles will increase in number, and the leaf hopper will now be able to spread the infection to healthy plants. In the normal course of events, however, the leaf hopper first acquires the virus by sucking it into its body with the juices from infected plants.

Once the insect has become infected, it cannot immediately proceed to introduce the virus into plants. The virus requires a period of incubation in the insect host. An interval of two or more weeks must elapse before healthy plants can be inoculated successfully. And the plant will first show the signs of infection three weeks later. But once the leaf hopper is capable of infecting plants, it can transmit the virus to new specimens every day or at other intervals for quite a long time, possibly until it at last dies of old age.

Now, what happens to the insect harboring the virus? Does it show any physical signs of being parasitized or of being indisposed in any manner? Close scrutiny of infected leaf hoppers has failed to indicate that they look or act differently from those known to be free from the virus. This, of course, does not mean that the insects may not be actually suffering from some obscure disturbance of body function that may not be readily obvious.

On the other hand, it may be to the advantage of the virus not to kill the insect. It may be that the ultimate goal of this virus is the tissue of plants, so that it would be necessary to its survival to have healthy leaf hoppers actively engaged in spreading it to new plants. The sparing of the leaf hopper from the ravages of disease may thus be an adaptation through which the virus derives the benefit later on. In this respect it is rather significant that the wound-tumor virus, like most other leaf hopper-carried viruses, is not transmitted from the infected female insect to her eggs. It would almost appear from this that the virus is avoiding interfering with the delicate processes of embryonic development. Such an intrusion might possibly curtail the production of healthy crops of young leaf hoppers that would later be needed for the all-important job of spreading the virus to new areas.

A similar scrupulousness seems to exist with regard to the infected plant. Only a few plant viruses are known to pass into the seeds. Wound-tumor virus is one of the majority that do not. Does this not seem akin to the fattening of a victim for the inevitable kill? Obviously the virus can do a better job of propagating itself in a mature plant than in a puny seedling.

We must not assume, of course, that there is anything even remotely suggesting design on the part of the virus. Such romantic speculation on the part of naturalists has long been discarded as fruitless in the interpretation of how organisms respond to their environment. But the activities of the virus do reflect a remarkable series of interlocking adaptations geared to self-perpetuation—adaptations that would do credit to a higher organism. The scientists who study evolution know that it takes a very long time for a species to perfect a highly polished and delicately adjusted adaptation. This shows that the virus, far from being a newcomer on the scene, has been around for a long time.

There is something unusual, too, about the tumors that appear on the diseased plants. These growths are frequently associated with a wound or injury to the tissues. In the roots, for example, they develop at the sites where new rootlets push through the tissues to reach the soil outside. This phenomenon was demonstrated by an experiment by Dr. Black. Infected sweet clover plants were pierced at various points along the stem with insect pins. At most of these spots tumors developed.

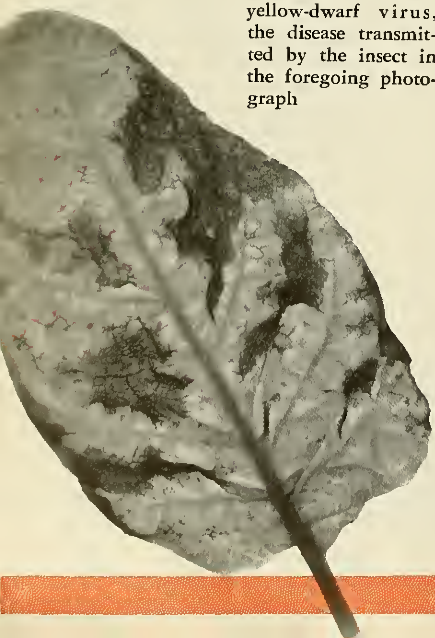
Now, it has long been known that injuries to animal and human tissues may produce cancerous growths. Viruses have also been implicated in a number of different types of tumors in animals, particularly in rabbits and poultry. Plant tumors, of course, are not the same as animal cancers. They do not, for example, spread from one growth site throughout the body of the organism.

But it may well be that a virus-injury relationship may be found to play an important role in the origin of certain abnormal growths in humans and animals. Dr. Black has already pointed out the startling resemblance that the wound-tumor virus of plants bears to the virus responsible for breast cancer of mice. The significance of the wound-tumor virus work has not been missed by authorities on cancer, for the American Cancer Society has contributed financial support for the research at the Brooklyn Botanic Garden.

Depending on the species of plant, the tumors may vary from pustules to fairly large spheres that may cover the entire root and be firm and woody in texture. As the tumor first develops, it seems that it is trying to produce normal tissues. But this effort at normality lasts for only a short while. Soon

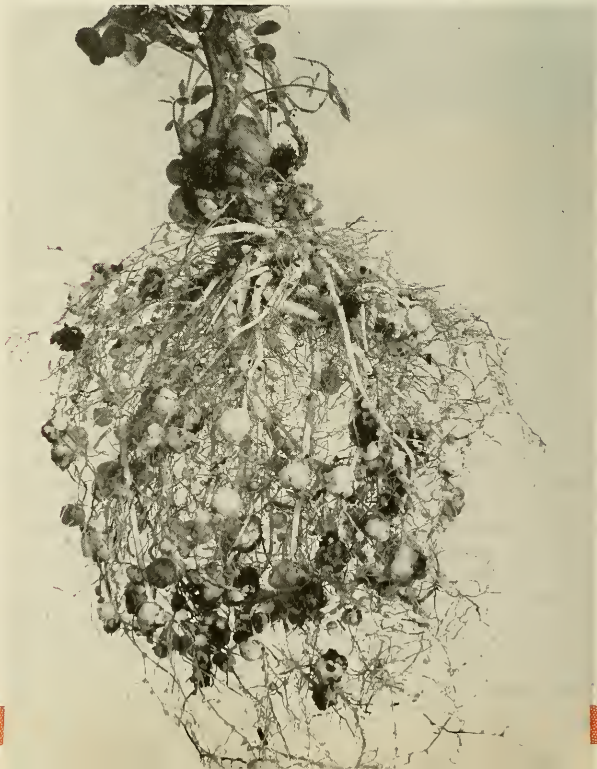
▲ PORTRAIT of a clover leaf hopper responsible for transmitting potato yellow-dwarf virus into plants. This virus produces severe destruction but without tumors.

▼ A VICTIM of a severe strain of potato yellow-dwarf virus, the disease transmitted by the insect in the foregoing photograph



▼ ROOTS of a sweet clover plant badly infected with wound-tumor virus. The round growths are tumors

Photos by J. A. Carlile



the struggle is given up, and the insidious process of degeneration takes over, with the cells taking on an irregular shape.

If tiny chunks of tumor are successively grafted to healthy plants, they can grow indefinitely. Likewise these pieces of abnormal tissue will thrive heartily in various synthetic media containing salts and organic compounds. Dr. L. G. Nickell has been studying the nutritional needs of isolated groups of tumor cells, and his findings are not only important to understanding the pathology of plant tissues. They may also clarify many of the secrets of normal plant growth and development.

But let's take a more searching look at the agents to which the wound-tumor virus belongs. The viruses are responsible for disastrous illnesses among humans, animals, and plants. But scientists have not been at all certain as to just what they are. Not so long ago they were commonly considered as complex molecules, made up mainly of nucleoproteins. It was suggested that they occupied a mysterious "no man's land" between dead organic matter and the most primitive living organisms. Few wanted to dignify them with the actual title of "organism," however.

There was considerable favorable opinion about their being the first primitive substances from which cells evolved on this planet. Some scientists even suggested that they were hereditary particles divested of the usual cellular apparatus—genes in a state of isolation.

Strong support for such an idea came from the dramatic discovery several years ago by Dr. Wendell M. Stanley that the virus responsible for mosaic disease of tobacco plants could actually be isolated in the form of crystals. Added to this was the fact that viruses did not appear to have all the characteristics that have always been associated with living organisms. At best, the virus was perhaps envisioned as a molecule just on the verge of being alive—but not quite.

But as investigators probed deeper into the problem, they found some disturbing exceptions to these attractive theories. For example, some viruses, such as those living inside bacteria (another instance, by the way, of "little fleas having lesser fleas") have a tadpole shape, with a tail-like structure sticking out from one end. Some of these bacterial parasites even have membranes like those of microorganisms. The view of some authorities that viruses are true organisms has been strengthened by these observations as well as by other evidence.

There is one thing that is true of every virus—it is always a parasite. No one has ever discovered a free-living virus. But viruses are highly special parasites. They can increase themselves only inside the cells of living organisms.

Parasitic organisms, in general, have perfected an elaborate array of tricks for eking out an easy existence at the expense of their more or less unfortunate hosts. And the more adept a parasite becomes in such a slothful way of living, the less use it has for certain organs ordinarily very useful in the hurly-burly business of trying to stay alive. Animal parasites can dispense with their sense organs and a good portion of their nervous systems. Muscles and the other apparatus for locomotion often atrophy and disappear. The parasite eventually deteriorates into a highly specialized reproductive machine for producing young.

In plants, there is the loss of the chlorophyll, which the parasite no longer needs to manufacture its food. There is also the perfection of organs for attachment to the host as well as those required for reproduction. Here, too, the parasite dispenses with as much as it possibly can.

How far can this process of degeneration go in a parasite with the organism still remaining an organism? The answer may well be the

THE VILLAIN of the piece, long invisible to the sharpest scientific eyes: potato ellow-dwarf virus as seen by the electron microscope. Each of the larger raised vhite particles is a virus. This is the largest plant virus known and the only eaf hopper-transmitted one ever photographed. Viruses have also been implicated n a number of different types of tumors in animals

Photo by Drs. M. K. Brakke, L. M. Black, and R. W. G. Wyckoff

virus—the ultimate parasite. It has literally done away with everything not absolutely essential to reproducing itself. What this means is that nearly everything that scientists have come to consider as fundamental to cells has been dispensed with as so much excess baggage. And in the course of such retrograde evolution, the virus has at last become reduced to a particle that is no longer protoplasm, as commonly understood. Its only function has become the process of converting the protoplasm of its host into more and more particles like itself. As we have seen in the cases of swine influenza and wound-tumor of plants, viruses may go through elaborately roundabout byways to perpetuate their kind.

A cynic might perhaps remark that such ingenuity at exploiting other organisms might better have been expended in achieving a free and independent existence. But such moral judgments, derived from a purely human standard of ethical conduct, have little or no meaning in nature, where the basic rule is to try to survive. From this standpoint, the virus may be considered a uniquely successful organism. Stripped down to the bare chemical essentials for maintaining itself as an entity, it has adapted itself in an astounding way to the habits of other organisms in order to insure its survival.

It would take us too far afield to attempt to explore the large number of serious virus diseases afflicting man, valuable domestic animals, and important economic plants. Suffice it to mention that in recent years the cattle-raising industry of Mexico has been almost completely demoralized by the wildfire-like spread of hoof-and-mouth disease. The threat of the possible invasion of this dread virus infection into our own country almost created a panic in our cattle industry, and our Government poured large sums of money into Mexico to aid in the fight against the virus.

Also in the last few years, the American people have watched with helpless horror the deadly and crippling blows struck by another virus—that responsible for infantile paralysis. And it was not too long ago that New York City mobilized all its resources in a mighty mass effort to immunize its vast population against another virus-caused plague, smallpox.

Who knows but that the findings on the humble sweet clover and sorrel may provide a basic clue to coping with our most formidable virus foes?

But the virus also presents a different sort of fascination. It is something that must confound a man-made system of morals. For we are here confronted with the supreme success of complete degeneracy. The virus represents the very last stage of retrogression in what once may have been, on our terms, a full-fledged and respectably independent organism. It is the consummate parasite, the most accomplished in its nefarious art. All other kinds of parasites are merely clumsy imitators of the virus's refined technique in robbing a host.

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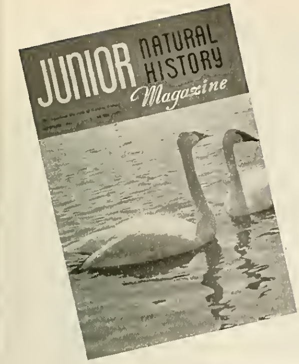

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BOOKS

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Since the end of the eighteenth century the world population has continued to increase until it is now several fold greater than it was in Malthus' time. This was possible in part through unforeseen technological advances which have produced a considerable increase in food production, but with an intensification of population pressure in a number of danger spots throughout the world. The fact that this increase was possible at all has blunted for many students the urgency of Malthus' principle. Only recently serious thinkers have once again become alarmed by the critical situation of a constantly increasing tempo of population growth with no proportionate addition in food supply in sight. Hardly 10 per cent of the land surface is suitable for efficient agriculture, and experts can see only moderate increases in yields, yet the world's population is likely to double in 75 years if it follows present trends. Much of this unbalance has arisen from the fact that while modern medicine has reduced the death rate drastically, the birth rate has not dropped in equal degree, and in some parts of the world has remained at high levels.

Mr. Cook, passionately concerned about this trend, has written an equally passionate book about it. But he goes further than this aspect of the problem, serious as it is. He is equally concerned about those countries of Western Europe and particularly the United States where contraception has become an effective method of controlling the birth rate. In these countries restriction of the birth rate appears to have become disproportionate in its distribution through the social structure. The situation has already arisen in the United States where a large part of its population replacement is coming from the most depressed agricultural areas of the country. The loss in quality that this course might bring about Mr. Cook calls "gene erosion." In his view it represents a dangerous trend that must be corrected by a general recognition of its utmost seriousness for our future national well being.

Mr. Cook has written an important book, full of zeal and pungent in style. It is a book that anyone can follow without specialized knowledge. Although I cannot accept all his premises and conclusions, I must admit that the necessity that we do a little serious thinking about these problems is so overriding that any book which serves that purpose must be received gladly and with joy.

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and picked our way with the same caution. In time its canyon opened into a second valley, larger but desolate and treacherous like the first. Here were more of the hissing vents and fumaroles, but at the far end loomed a U-shaped portal, flanked by high cliffs of smudgy black. From this arose clouds of steam in a continuous roar.

This was the place, and we viewed the famous lake. Picture a ring of high dark cliffs, devoid of plant or animal life. At their base is a narrow terrace of yellow mud, overlaid with a thin crust. This lips the lake. As for the latter, consider a stewpot. A large one may be a foot across, and the bubbles of steam breaking upon its surface may reach an inch in diameter. Our Dominican stewpot is 100 yards across, and the boiling bubbles are 30 feet or more in size. At first, one can see almost nothing, so dense is the sulphurous steam. Then a gust of wind tears the cloud away, and one sees black waters flecked with foam, on which these enormous bubbles rise and break.

Whup, whup, whup! First here, then there, these giant bubbles rise and burst, and sometimes, it is known, a superbubble almost the diameter of the whole lake rises to explode on contact with the air. Then, for the fraction of a second, the entire surface of the lake is like the convex crystal of a watch.

At such times, generally when the water level is below the average, this lake can be deadly, for poisonous fumes can rise and kill those near by. However, Cyril considered the water level safe, and with confidence I descended a slope to stand within ten feet of the boiling waters. A mist covered me, the smell of sulphur was strong, and I was warned not to approach too closely, lest the bank cave in and drop me to a quick death. For so a man had died. And two men had quickly died from fumes on the same spot at which I stood.

One does not remain long near the border of this lake. At first one feels wonder, but as the minutes pass, this gives way to a sense of evil and menace. "*Mais pourtant, c'est vraiment la bouche d'enfer,*" a French priest had said as he stared upon this pit. "The mouth of hell," and his words were apt, for the black cliffs rise like the walls of a dungeon, the earth is blasted and sickly looking, the sky is overcast with gloomy nimbus, and the boiling lake bears witness to fires not far beneath the treacherous crust.

On our way back, Cyril related the tragedy of the Clive party, of Mr. Clive the English traveler who made this trip to the lake with two guides some 25 years before. They came to the edge while the lake was boiling more furiously than usual, and Clive climbed one of the surrounding cliffs to take pictures. In the meantime, the two guides—one was named Wiley and the other Rowle (Cyril's grandfather) – approached the lip, at the same spot where I had stood. Suddenly, an enormous bubble, which all but covered the entire lake, rose, swelled so that its convex center stood ten feet above the rim, then broke into foam, releasing its gases into the air. The wind blew toward the guides.

Wiley fell where he stood, never to move again. Rowle, who happened to stoop down in a slight declivity where a rivulet sought the lake, escaped the worst of the gas cloud, but he felt a dreadful nausea. Clive scrambled down and stood beside him.

From Rowle's account, Clive refused to believe that Wiley was dead. He tried to revive him with brandy, while Rowle pleaded with him to leave the spot before another bubble should come. However, Clive could not grasp the danger, and belittling the warning, he ordered Rowle to return to Laudat for medical aid.

So bidden, Rowle left, and the last time he saw Clive alive, the Englishman was standing with his back against a bank, gazing down on Wiley. When, hours later, Rowle returned with the rescue party, Clive was still in the same position, looking down at the prostrate guide. Clive's eyes were open but saw nothing. He was dead, and so was Wiley. The bubble of death had risen and burst once more while Rowle was gone.

Such was Cyril's vivid story, which he had received directly from his grandfather. Since that day the boiling lake has claimed one more victim—an uncle of Cyril's. Circling the rim, he ventured too near. The bank gave way and carried him with it. He fell in only to his waist and managed to scramble back, but he was carried home in great pain; the flesh came off the scalded parts, and he died shortly.

One more thing Cyril mentioned. The temperature of this lake has been taken, and it is 219 degrees F. Since the elevation is a good 2000 feet or more above sea level, the sulphur and other minerals must cause a rise in the boiling point.

With such talk, we started our return, and at length stood once more on the summit of Morne Nicoll, with the desolate inferno far below. Now, a singular occurrence took place. As we had traversed the regions of the great pit, there had been no sign of bird or beast in all that mile-long valley. If one had been a superstitious native like those in the tiny interior villages, he would say that the valley was but a place for the revels of witches, demons, zombies, and *soucouyants*, a Dominican version of the summit of the Hartz Mountains on Allhallows Eve. It was no place to linger. Now we were out of it.

Suddenly the sun, which had been obscured all day, burst through the clouds, and a wide patch of blue sky made a cheerful appearance. We stood enjoying the warm rays, when from some hidden spot near by there arose, high, sweet, and clear, like the notes from a flute, the call of a bird. It was the song of the Siffleur Montagne, the famed songster of these jungles. It was like an all-clear signal—a sign that we were free from the dangers of the region of the Boiling Lake.

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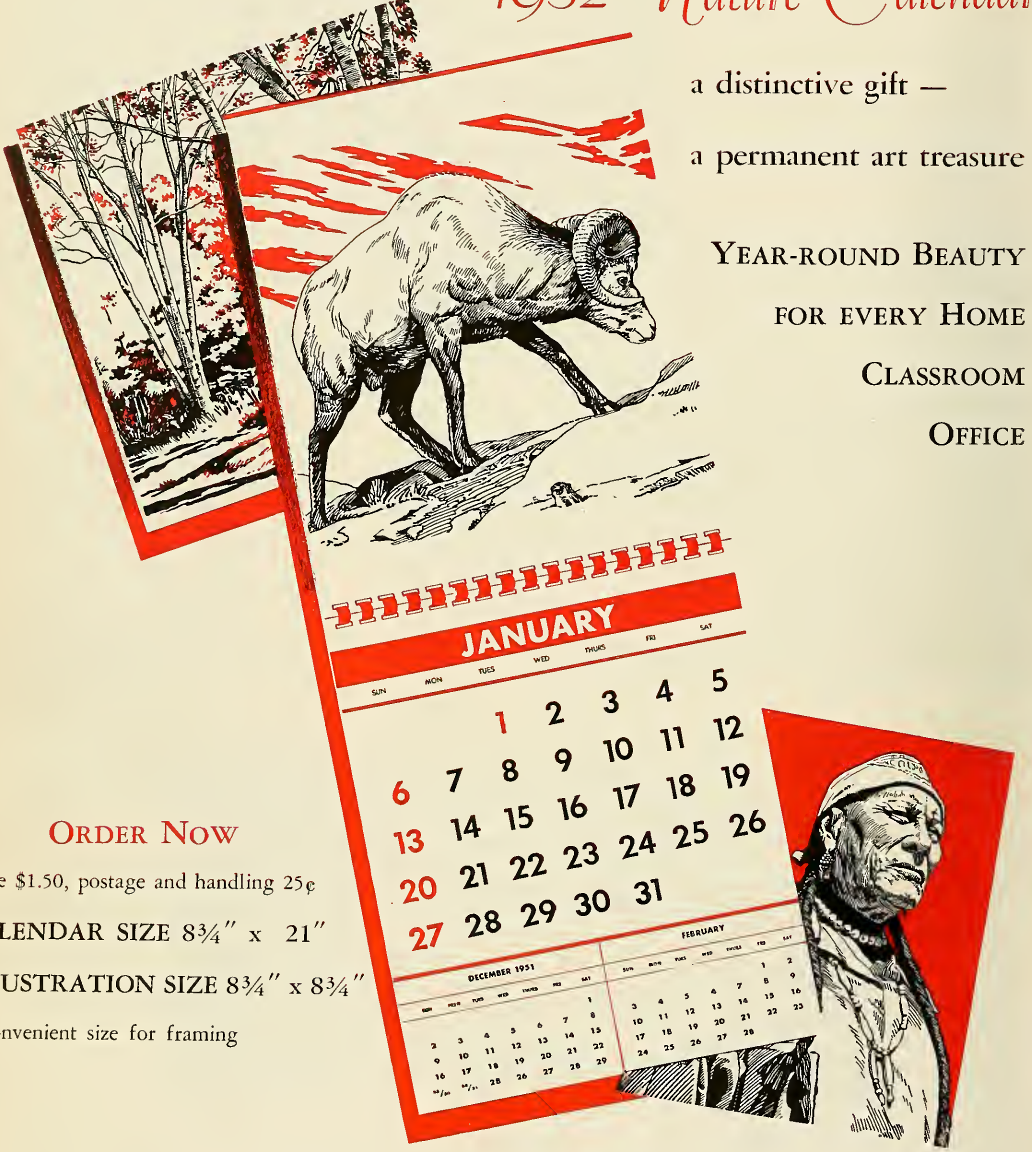
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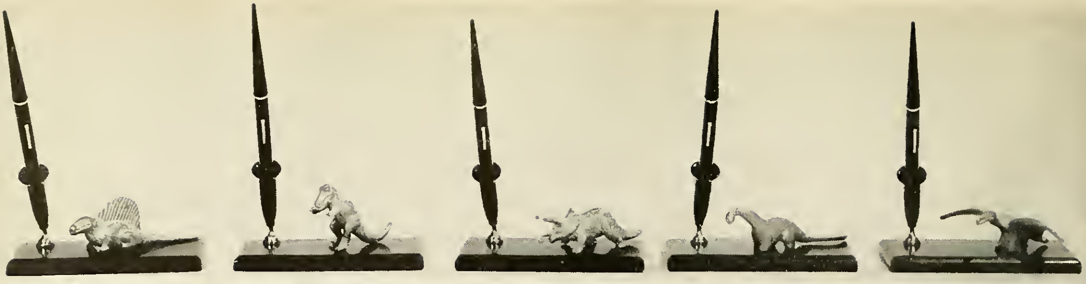

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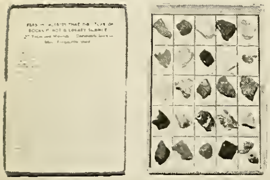

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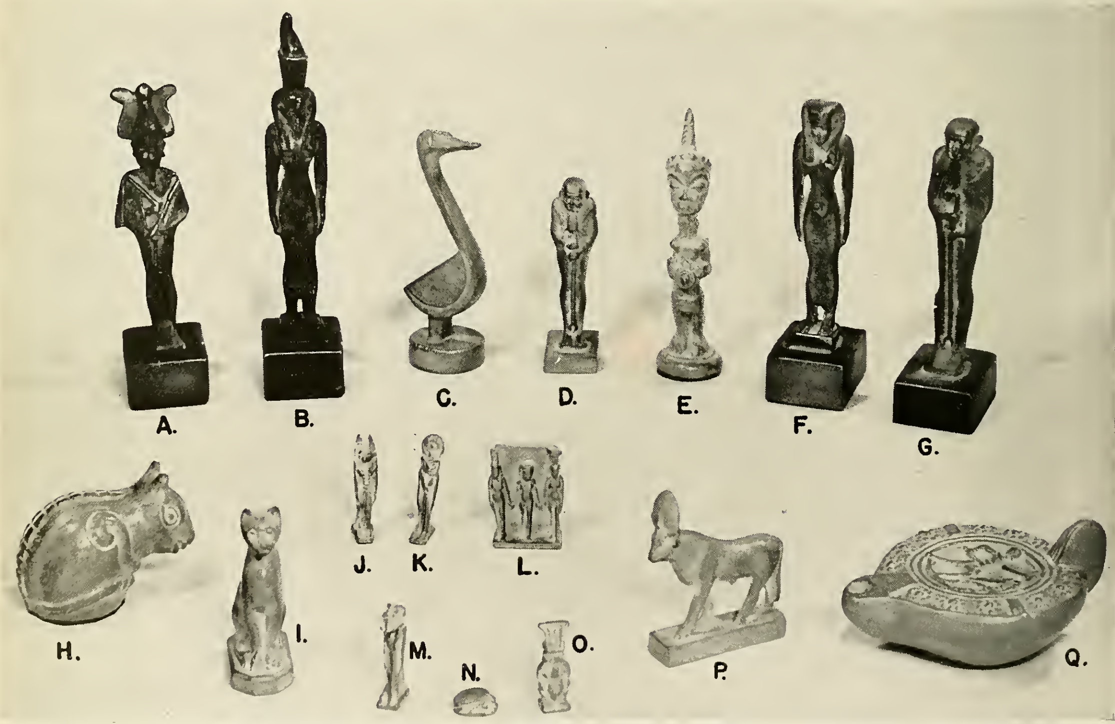

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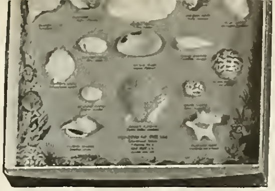
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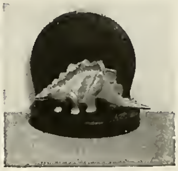
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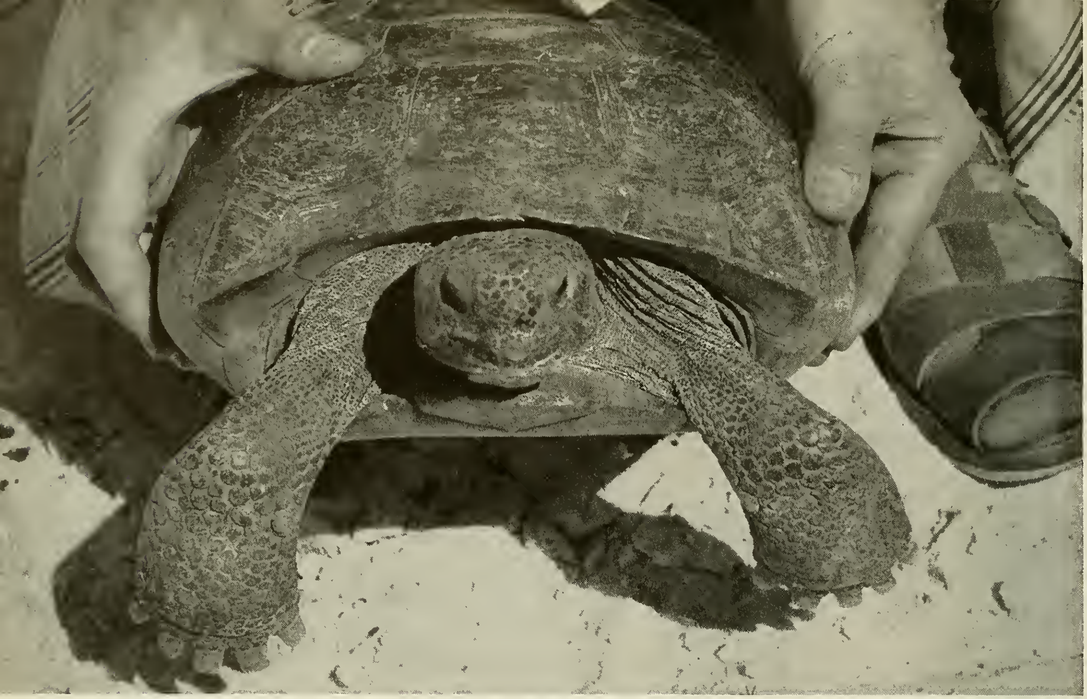

Lorus J. Milne photo

LETTERS

Not Manicured

SIRS:

While savoring Myron Gordon's article entitled "How Animals Get Their Names" (NATURAL HISTORY, October) we recalled having made the acquaintance of the gopher tortoise in Florida, shown in this photograph. Your artist showed the digging claws of the mammalian gopher but not the fine fingernails of the gopher tortoise, which are seen here to good advantage.

LORUS J. and MARGERY J. MILNE.

Durham, N. H.

An excellent photograph showing how the usually more pointed fingernails of the gopher tortoise are sometimes worn down.—ED.

Gray Wolf—Pro and Con

SIRS:

I would like to congratulate you on that interesting and fine article entitled "Can We Save the Gray Wolf?" by Edwin D. Neff in the November NATURAL HISTORY.

This very fine Magazine is in our school library. I have found it to be very interesting and helpful!

Isn't there anything that can be done to save the gray wolf from extinction?

RUTH PETERSON

Austin, Minnesota

* * * *

SIRS:

I was amazed to read an article in the November issue, defending the gray wolf, which definitely should be destroyed if we are to retain our big game.

If the gray wolf is not exterminated in Alaska and the Yukon, it will destroy all the herds of caribou, mountain goats, and moose; and I am amazed that you would run an article of this kind in your very excellent magazine.

WALLACE J. OSBORN

Fairfield, Conn.

DEAR MR. OSBORN:

As editor of NATURAL HISTORY, what I can say may be of little value because I am neither a hunter of big game nor a wolf chaser. However, when I was in Alaska a little over 20 years ago, this uproar against the wolf had not arisen. There was a good bit of big game in the territory, and the wolf was there too, as he had been since time immemorial. The wolf had not killed off all the big game in Alaska during those many centuries he had had a chance to, and so I am personally not quite ready to accept these dire predictions against the wolf.

As the article freely admitted, the wolf is a menace to domestic stock and, by the same token, to semidomestic herds of reindeer. But I believe one can fairly ask how much of the anxiety might not better be laid to disturbances in the natural balance caused by man, because the much larger herds of migrating caribou in the north of Canada have survived despite the wolves, at least up to the advent of firearms.

Though the ideas expressed in the article you refer to are Mr. Neff's and not mine, I admired the article greatly, because the question is an intricate one, and the article tried honestly to show both sides. Admittedly the wolf is a predatory animal. But whether on that basis alone we would be justified in sentencing it to extinction is not easy to say, particularly when, if the balance of nature has not been disturbed by man, the animal survives in harmonious proportion with other creatures.

Please do not think that I am ready to turn the world over to the wolves and let man retire from the scene. My own nature is predatory enough to reject such an alternative. But I do think that that is the question involved here, rather than the idea that at this particular point in history the human species has arrived just in time to save all the other animals from the wolf.

Many persons undoubtedly share the impression that most of the blame for loss of animal life in Alaska can be put on the wolf. But Ira N. Gabrielson, President of the Wildlife Management Insti-

Continued on page 48

NATURAL HISTORY

The Magazine of the American Museum of Natural History

Alexander M. White, President
Wayne M. Faunce, Vice-Director
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VOLUME LXI—No. 1
JANUARY, 1952

Lapps....................................Cover Design
From a color photograph by Irene Morden

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A little-known natural wonder

The Friendliest Bird I Know........Hugo H. Schroder 14
If you want to see how trusting a bird can be, present yourself to the Florida Jay

What Ever Became of Jumbo?.....George G. Goodwin 16
King of elephants, pet of thousands, and friend of two continents

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A photographic display

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A glimpse into the life of the Lapps

Portrait of Hydra....................N. J. Berrill 30
This creature has astonished scientists and amateurs alike with its fantastic performances

His Royal Highness, the Jaguar..................... 35
The largest catlike animal of North America dominates a scene in the Museum's Hall of North American Mammals

Butch—the Raucous Rascal.............Eric Cameron 36
When the author adopted a baby crow, he didn't know he was in for endless surprises

Broley Bands 'Em High............Myrtle J. Broley 40
Since retiring, Charles L. Broley has banded more Bald Eagles than all the other bird banders put together

You will find Natural History Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

These are the Lapps—those nomads of the European Arctic. Their bright colors were by no means put on for a gala occasion. The brilliant blue tunics, trimmed with bands of bright red and yellow felt, are quite characteristic of their ordinary summer dress. In the long winter the skins of their reindeer will protect them from the Arctic cold. This picture was taken last summer at Overgord near Tromsö in northern Norway, by Irene Morden.

There is much about these Lapps that will suggest to the reader their possible Asiatic origin. The man and woman in the picture are mountain Lapps. There are also forest Lapps, sea Lapps, and river Lapps. Each group has special customs and characteristics. The primitive way of life of the mountain Lapps still centers today, as of old, around their great herds of reindeer, which in large measure feed them, clothe them, and furnish their means of transportation. And these sturdy people—numbered now in thousands only—display amazing powers of endurance in following their herds in seasonal migration. An article on the Lapps will be found on page 24.

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The American Museum is open to the public every day in the year without charge

Some Questions and Answers about "Chase Services" to the Petroleum Industry

One of the first banks to have a Petroleum Department (formed in 1936), Chase today is one of the few banks offering the oil industry this special service on a national scale. Below are some questions and answers showing WHY Chase offers this special service and HOW it pays oil men to do business with Chase.

One of Chase National Bank Services: **PETROLEUM DEPARTMENT**

Q. Why does Chase have a special Petroleum Department?

A. First of all, to offer the fastest and most comprehensive service possible to oil men . . . and because the problems of the industry itself are so specialized, only trained specialists can efficiently handle them. In addition, the rocketing growth of the industry required that it have its own "bank within a bank"... and that's what Chase's Petroleum Department is.

Q. How is this Department set up?

A. It's one department with these three divisions: 1. Engineering — composed of engineers and geologists... experts found and hired by Chase in the country's largest oil-producing sections. 2. Economics — composed of trained Petroleum Analysts. 3. Credit and Banking Division — composed of experienced Chase bankers who devote their time exclusively to problems of oil-industry finance.

Q. How does this department operate in the case of a loan request by an oil company for a planned expansion program?

A. Chase's Petroleum Department is so well-briefed and studied in all developments of the oil industry, that there have been times when they've approved important loans right over the phone!

Its customary investigation operates in this manner: First the Engineering Division — Chase's geologists and engineers make a thorough investigation of the property involved to determine its present and potential productivity. They check all plans for drilling, transporting and refining the crude oil to help assure smooth, efficient operation. Then the Credit and Banking Division — Chase's "Petroleum Bankers"—working with the data supplied by the Engineering Division, estimate the amount of cash return the property will generate. They also study the reports of the Economics Division showing expected market prices and demand for the product. Then on the basis of these facts and projections they approve or disapprove the loan request.

Q. Is this special Chase service primarily designed for the bank's protection?

A. Absolutely not. First and foremost, it is designed to protect the Chase client. This protection and extra service, plus the availability of Chase's vast resources, are the big reasons so many out-of-town oil companies come to Chase in New York . . . why Chase's correspondent banks often refer accounts directly to them. Through its specialized ability in the oil industry, The Chase National Bank has come to be known throughout the country as the oilman's bank.

Q. How does it pay OIL MEN to do business with Chase?

A. In the first place, Chase's advice on petroleum operations and financing makes possible important savings. In addition, Chase customers, by utilizing the services of Chase Petroleum Specialists can forego hiring otherwise necessary, and very high-salaried consultants.

You may have other questions concerning Chase's Petroleum Department, or questions about one of the many other special services Chase offers industry. Why not talk to the people at Chase . . . and learn why

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In addition, Chase specialists, out of their broad experience with large railroads in the field, showed me a number of ways in which I could improve my operation.

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DIVING TO ADVENTURE

- - - - - - - - - - - by Hans Hass

Doubleday & Co., $3.75
280 pp., 58 photos

THIS book is an exciting account of the experiences of a daring "goggle-fisherman" and pioneer of underwater photography. It is one of the first books to describe so vividly the thrills of submarine hunting, the most sporting fishing method, where the hunter, equipped with only a harpoon and superior intellect, confronts the fish in its own element.

In a delightful narrative style, mingling humor and drama, Mr. Hass relates how his hobby-profession first began while vacationing on the French Riviera in 1937. He tells how he pursued his subject in the Mediterranean and later in the West Indian coral reef waters, where he and his companions encountered some of the most dangerous marine animals known.

The dangers insinuated in some of the incidents described will undoubtedly be exaggerated in the minds of most readers (such as the close encounter with the harmless dolphin in a place consequently called "Death Bay," the knife attack on a docile nurse shark, the dramatic avoidance of a fish mysteriously alluded to as resembling a setting sun—undoubtedly the small poisonous scorpion fish, which, however, is harmless if speared and handled carefully, etc.). However, Mr. Hass certainly has invited and has been involved in hair-raising and truly neck-risking situations.

Although spearfishing and underwater photography can be thoroughly exciting and enjoyable and perhaps more scientifically fruitful without repeatedly risking one's life as Mr. Hass has done, there is no doubt that such risks have brought his adventure story into the realm of the spectacular. In his undersea explorations, Mr. Hass' entanglements with giant fishes and near drownings and his escape from the jaws of a tiger shark will thrill many readers. Mr. Hass has done a fine job of presenting a limited but fairly accurate picture of the underwater world and the activities of its inhabitants as seen by goggle-fishermen. This picture is supported by 58 photographs in black and white, 48 of which were taken under water. Some of the latter are superb and distinctly unique.

Originally published in Austria in 1947 under the title "Drei Jäger auf dem Meeresgrund," much credit for the readable style of this book is due the translator, Barrows Mussey.

EUGENIE CLARK

THE APE IN OUR HOUSE

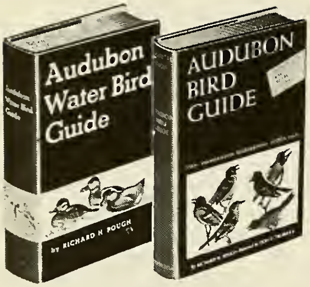
- - - - - - - - - - by Cathy Hayes

Harper & Bros., $3.50
247 pp., 33 photos

WITH the wider acceptance of evolutionary views, it becomes increasingly important to know just how we differ from the anthropoids. The mythical Tarzan, reared among chimpanzees, soon outstripped them. Keith and Cathy Hayes reversed the procedure by adopting a new-born chimpanzee from the Yerkes Laboratory at Orange Park, Florida. They are psychologists, and they reared their little Viki like a human child, in order to learn when and how she would diverge from the usual course of human development. Her care provided Mrs. Hayes with a full-time job. The furry baby was clothed like a little girl. She had the freedom of a house and garden, behaved rather better than might have been expected, but was far more active and acrobatic than a human child of her age.

Efforts were begun early to enlarge her vocabulary beyond the usual expressions of chimpanzee emotions. After she could say "ahhh," fingers applied to her lips taught her to pronounce the consonants "m" and "p," to say "mama" and "papa." Yet she never realized that each signified a different person. The third word learned was "cup," which Viki used to express her wish to drink. Her chimpanzee vocabulary already included a food call; she could smile or laugh silently when pleased. By imitation she learned to do many surprising things, but without the ability to learn by words she could never tap the store of knowledge that so soon becomes available to the human child. Mrs. Hayes doubts that more than 50 words of English could ever be understood. At age two, Viki was falling behind.

With the close of this entertaining and illuminating book, Viki has reached three years. She enjoys company and parties. She can use many tools, do simple jigsaw puzzles, open knots and padlocks. How



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far can she go? What will happen in adolescence? Some day the Keiths will tell us more. If Viki is not quite human, how much of the ape survives in us?

James P. Chapin

AUDUBON WATER BIRD GUIDE

- - - - - - - by Richard H. Pough

Doubleday & Co., Inc., $3.50
352 pp., 623 illusts.

Mr. Pough's *Audubon Bird Guide*, covered the small land birds of eastern North America north of Mexico, excluding East Greenland. The work was very favorably received and has since been used widely. This new book is a companion volume covering the water, game, and large land birds of the same area. Retaining as it does identical features of format, organization, and style, it is almost certain to enjoy a like response.

The main body of the text treats separately each of the 258 species. Nearly all the important plumages are depicted in an impressive array of 623 illustrations. Four hundred and eighty-five are in full color by Don Eckelberry. These are cleverly grouped on 48 plates, which occupy the middle of the book. The remaining 138 are in black and white by Earl L. Poole and have been placed in appropriate positions in the text. There are also informative maps on the end papers. The one at the front shows the major flyways of eastern North America and 10-degree squares of the North Atlantic on which are marked surface temperatures and bird abundance. The one at the back, a reprinting from the earlier work, shows the boundaries of the life zones superimposed on a map of the North American biomes.

While the author's principal purpose is to provide a ready guide to the identification of living birds in the field—a purpose that is admirably fulfilled—, the book is at the same time a compendium of significant information on the species concerned. Habits (e.g. habitat preferences, peculiarities of flight, food, and feeding habits), voice, nest (location, structure, number and color of eggs), and range are indicated or described. When interesting matter concerning a bird is not understood and thus warrants further investigation, attention is called to it. By using a system of abbreviations, the author has managed to include in a remarkably small space a vast amount of factual material relating to each species. Some of this condensed information, such as the size of territory, number of days involved in nest construction, the maximum age known to have been reached by an individual, and the average normal flight speed, has hitherto been unavailable in any one book.

Great praise is due Mr. Eckelberry for the quality of his illustrations. All have a satisfying combination of liveness, clarity of outline, and accuracy.

Olin Sewall Pettingill, Jr.

CLIMBS IN THE CANADIAN ROCKIES

- - - - - - - - - by Frank M. Smythe

W. W. Norton, $4.50,
260 pp., 42 illusts.

Frank Smythe, while one of the most famous of modern mountaineers, is very far from being that alone. In addition he is bushman, naturalist, botanist, and author, to mention only a few of his qualifications. In my own library I have another of his books, *The Valley of Flowers*, which deals with his earlier journeyings in the Central Himalayas and is written in the same delightful, expansive, and enthusiastic vein as this.

At my first hasty leafing-through of this book I found that Mr. Smythe carried me from subject to subject with graceful and sometimes stupendous abandon. In that hurried glance, I struck such varied and fascinating subjects as the training of British and Canadian ski troops, how to frighten a bear, the building of an igloo, episodes in the life of the odious Dr. Cook, and a whole chapter on the life and habits of the beaver. These comments are made early to show the reader that he does not in this book, like the famous Duke of York, simply "march up the hill and then march down again."

Perhaps to the less dyed-in-the-wool climber, some of the other activities would bear enlargement even at the expense of the descriptions of the actual climbs. That is a matter of taste, however, and early in the book the author makes the point that the climber must possess other attributes, notably that of bushmanship, or else he will never, in the less traveled parts of the world, even reach the foot of his mountain.

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Physically, the book is broken into two parts, with the first containing the more varied topics. The second deals with ascents of the peaks of the Lloyd George Range, in the remote northeast Canadian Rockies—an area that is not shown on any small-scale map or atlas. It makes delightful reading; in fact, there are things in this book that, I think, will please and interest almost anybody.

The illustrations are plentiful and good, but it seemed to me that the black-and-whites were more realistic than those in color.

Geoffrey M. Tate

HEAVENS ON EARTH

- - - - - - - - - by Mark Holloway

Library Publishers, $4.75
240 pp., 14 illusts., 1 map

THE communal and utopian societies that flourished or floundered in the United States from 1680 to the end of the nineteenth century have a special fascination out of all proportion to their significance in our history. That is not to say they had no part in shaping national attitudes. As a matter of fact, antislavery as a confirmed stand first appears in certain German communities in Pennsylvania. An enlightened consideration for the rights of women emerged in some of these groups long before the country at large was prepared to grant women equality. Experiments in education were tested in others, leading to reforms that eventually exerted a wide influence. On the esthetic side, the furniture designed by the Shakers has become a part of our tradition.

Many of the communal societies originated in Europe, coming to America to escape the restrictions or persecutions of the Old World. For the most part the early groups, largely German, were religious, pietistic communities seeking to recover a primitive Christianity. Most of them survived a relatively short time, torn asunder by internal stress or debauched by secular influences. It was not until the nineteenth century that colonies based on sociological ideologies, typified by Owen's experiment at New Harmony, began to appear. Fourier's influence, another importation, also gave rise to a number of communal groups known as phalanxes. The famous Brook Farm in Roxbury, Mass., was deeply influenced by this movement, particularly in its later phase.

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Perhaps the most indigenous of all these efforts to establish Utopia was the Oneida colony founded by the brilliant John Humphreys Noyes. Beginning in Vermont as a group of families sharing a common philosophy of life, the group eventually moved to Oneida, New York, where they achieved a material success by their technological progressiveness and a disastrous notoriety through their peculiar sex conventions.

Although most of these communities were short-lived, some have had an amazing vitality. The Shakers, established in the latter part of the eighteenth century, still survive in a few sadly reduced houses. The Ephratans and Inspirationists lasted over 100 years, and the Rappites continued almost as long.

Mr. Holloway, who tells the story of these colonies in *Heavens on Earth*, has resurrected many of the almost forgotten ones and has reminded us again of the excitement that attended the better known attempts at establishing a better world. He has not omitted the amusing detail, the eccentricity, or the burning faith that characterized them all in some degree.

Harry L. Shapiro

KON-TIKI AND I

- - - - - - - - - by Erik Hesselberg

Rand McNally and Co., $2.50
74 pp., numerous drawings

IN this rollicking account of the Kon-Tiki expedition, Erik Hesselberg has perhaps given the world something as novel in description as the voyage was in fact. At least it is hard to find an adequate label for it, since it comprises the accuracy of a ship's log, the artlessness of a boy's diary, and the mysticism of a Norse saga all rolled into one and overlaid by an up-to-date sense of humor. Also the many clever drawings are so closely interwoven with the writing that the one would have no continuity without the other.

Unlike Heyerdahl, Hesselberg has no scientific axes to grind. Indeed, the events of the trip, both trivial and important, are related with equal zest and in an entirely uncritical spirit. Thus *Kon-Tiki and I* should be read only as an amusing sequel to the more substantial *Kon-Tiki* of Heyerdahl.

G. H. Childs

THE PHEASANTS OF THE WORLD

- - - - - - - - - by Jean Delacour

Country Life, London; Charles Scribner's Sons, N. Y., $35.00, 347 pp.; 32 plates (16 in color); 21 maps and diagrams

AMONG the many beautiful and ornamental birds of the world, the pheasants, because of their large size and the comparative ease with which they can be displayed in aviaries and zoos, occupy a commanding position. Small wonder then that they have long been favorites with all who appreciate that which is beautiful and unusual in the world of nature. Elliot's great monograph of the pheasants, illustrated by the magnificent paintings of Joseph Wolf, is now to be found only in the largest libraries. William Beebe's equally elaborate treatise on the same group of birds is now unavailable, and in the years since its appearance many important discoveries have been made, the most exciting perhaps being the discovery in Africa by

Continued on page 46

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Preview of a little-known
NATURAL WONDER

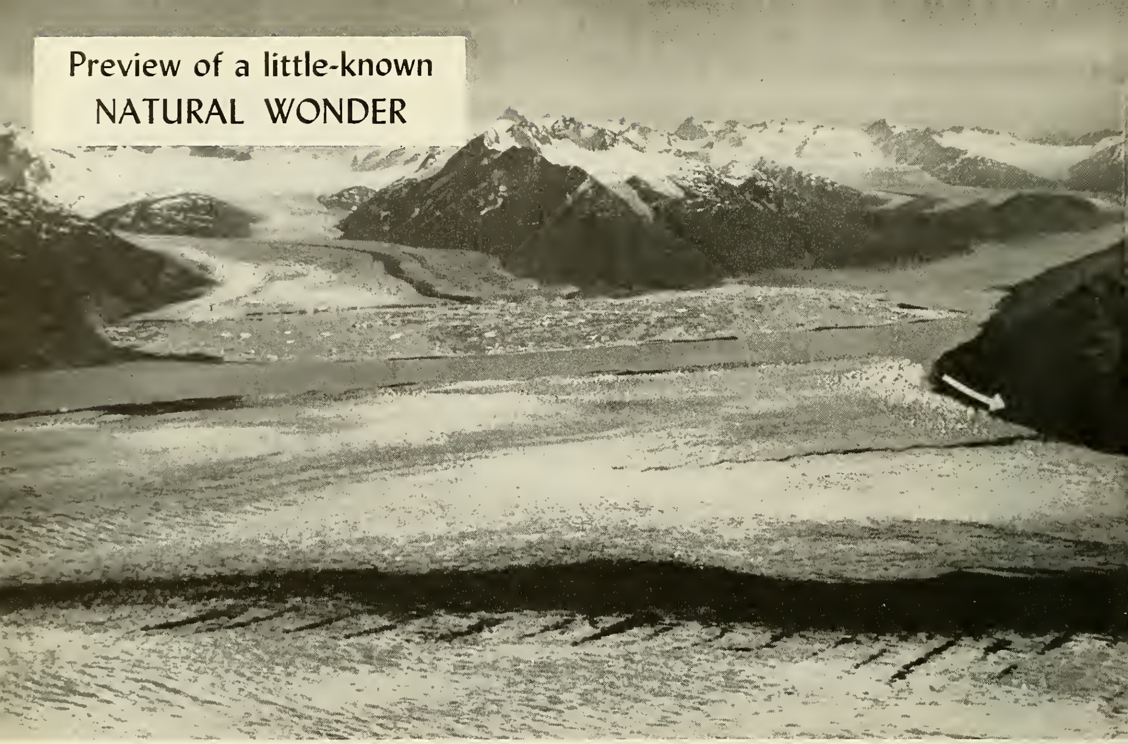


Photo by P. W. Hol

▲ Lake George with the lower portions of Knik Glacier barring its escape in the foreground. The lake will flow out along the arrow at the edge of the mountain at right. Floating ice issuing from the snout of Surprise Glacier (distant l
covers part of the lake. It is about four miles from Knik Gla
to Surprise Glacier across the lake at center left

Self-Empying Lake

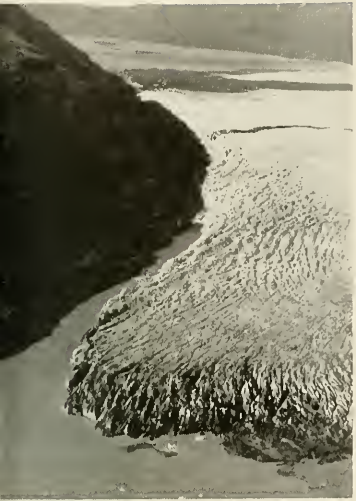
When the mood strikes her, Lady Wonder Lake kicks up her heels, pulls the plug to nature's bathtub, and pours perhaps several hundred billion gallons of water into the sea

By Ida B. Alseth

IT is because of the precarious country—precipitous cliffs, matted forest growths, and rugged mountains—that Lake George, in the fringes of Alaska's Chugach Mountain Range, is so little known except to residents of the immediate area.

Lake George does not perform as often as Old Faithful, and its act is quite different, but when it bursts its bonds, it displays a power and grandeur that will long be remembered by the relatively few persons who have witnessed it. It lies only 40 air miles from the city of Anchorage, Alaska, and there has been talk of billing the self-emptying lake as a tourist attraction. But under present conditions it is difficult to reach a good vantage point from which to watch the performance—difficult also to predict when it will occur.

This lake is no modest lady that sits quietly only to reflect the deeply-hued Alaskan skies. At regular intervals, she kicks up her heels, pulls the plug to nature's bathtub, and allows her waters to tumble *oto by P. W. Holzgraf*



Looking downstream from the foot of ke George. Around August first on the erage, the lake cuts a channel where the meets the mountainside and dashes to e flats below in a raging torrent

uproariously down the gorge that forms her outlet. She sends huge chunks of glacial ice hurtling down the channel, and within a day or so, an avenue five miles long has been cut through the ice.

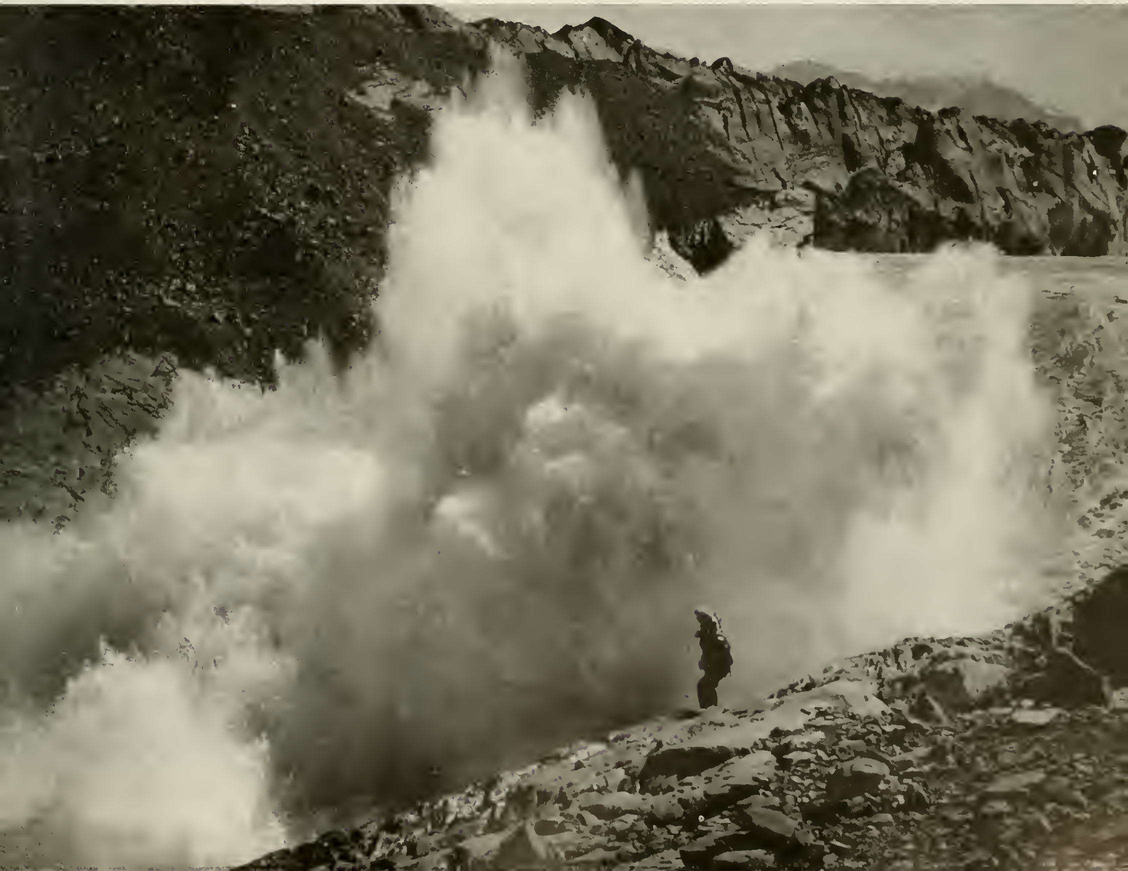
Until this happens, the lake's natural outlet has been blocked by the lower portion of Knik Glacier. This Glacier, in descending its valley, thrusts itself four or five miles across the mouth of the valley containing the lake. The lake cannot escape to the sea until it cuts a channel at the end of the glacier where the ice abuts against the rising valley wall.

On one of the best existing maps, Lake George is shown as being about 15 miles long and 4 miles wide at the widest point when full, but these figures imply a much bigger body of water than is there. The lake is shaped like a golf driver, and the "shaft" is much narrower than the "head." As is suggested by the steep slopes surrounding the lake, it is quite deep.

Through the early summer, the meltings from neighboring snow fields and glaciers gradually raise the level of the ice-dammed lake. Looking down upon the placid waters on a still summer day, one might not suppose any action was in store. But Lady Wonder Lake is not as complacent as she appears. Slowly she garners her strength; then she kicks out her glacial prison windows to hurl perhaps several hundred billion gallons of pent-up water down the deep gorge.

▼ **When the wonder lake** breaks through the melting dam, the pent-up waters cascade over a rock falls, as shown here. Large pieces of ice are undercut and carried along. One of them has apparently just fallen

Photo by Dom C. Knudsen



Photos by P. W. Holzgraf

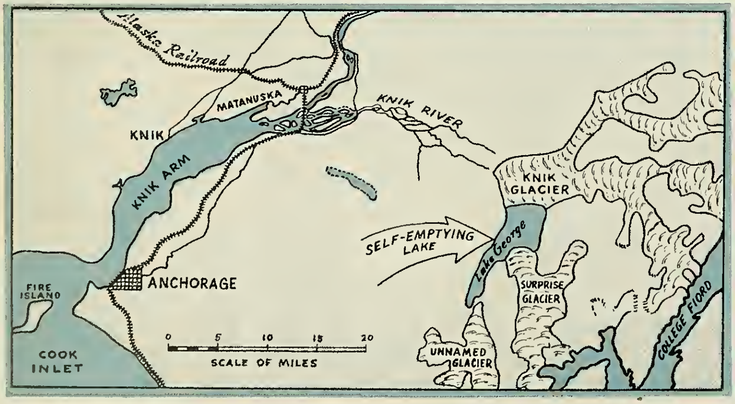
▲ **The glacier** that dams the lake has its origin high up in the Chugach Mountains, southeast of the famous Matanuska Valley

The water first melts its way under the ice where it butts against the mountainside. As the channels are enlarged, the process is speeded up. Undercutting weakens the ice, and, aided by the summer sun, the river grows to the proportions shown in the accompanying photographs, with ice arches collapsing to fill the churning waters with sizable fragments. It is about five miles through the ice barrier, but once the water starts to move through, it does not take long to open the channel completely. In only a day or so the river is "in full production."

Loose material, scoured out of the valley bottom by the glacier, is taken up by the turbulent water in its mad rush, and the flood plain below bears evidence of this burden. The valley bottom is comparatively flat in its lower reaches, and the Knik River, a braided stream that normally threads its way quietly through many channels, rises with the floodwaters from Lake George. Along the wooded edge of the floodplain or on the banks of tributary streams, trees are undermined and added to the flood. These may cause difficulty downstream.

The spectacle ends when the lake

▼ **Map** showing location of Lake George with reference to Anchorage and Matanuska. The positions of the glaciers in relation to the self-emptying lake are necessarily approximate


Alaska Railroad
MATANUSKA
KNIK
KNIK ARM
KNIK RIVER
KNIK GLACIER
SELF-EMPTYING LAKE
Lake George
ANCHORAGE
FIRE ISLAND
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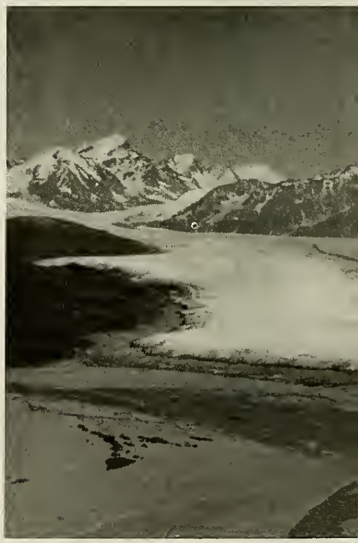
SCALE OF MILES
SURPRISE GLACIER
UNNAMED GLACIER
COLLEGE FIORD



becomes three smaller lakes. Then once more Lake George might be said to have become the epitome of Gregorian piety, except for the moaning and groaning of the ice and the crash of splitting bergs when there is sunshine. The floodwaters slowly recede in the valley below, eventually allowing the Knik River to return to its natural size. However, this may be a matter of months, because drainage into the lake continues normally in accordance with weather conditions.

How much this demure Wonder Lake has influenced the topography of the area is hard to say. There is no doubt considerable shifting in the channels of the lower Knik River as in other stream beds of this type where high and low water alternate to cause alternating erosion and deposition. If we are to believe a hydrographic survey of Knik Arm and Cook Inlet in 1914, the bottom of Knik Arm has been modified by the periodic floods. Knik Arm is an inlet from the sea about 25 miles long and up to 5 miles wide. R. S. Patton speaks of the mud flats on the north side of the arm opposite Fire Island as not having existed at one time. This area is several miles in extent. He also says that the boat channel up Knik Arm originally followed the north shore to a little above the old town of Knik, now extinct. From there, it turned up toward the center of the arm and thence to the mouth of Knik River. The debris brought down by the floodwaters from Lake George entirely filled up the channel, and new ones were cut.

Although few persons make the arduous trip to the break-through in the upper chasm, faithful spectators gather downstream at the bridge where the highway crosses the flats. As the time approaches, special crews of workmen are also dispatched to "hold the fort" where the railroad crosses the flats in a series of trestles. When the water is finally disgorged and comes racing down the valley, the crews work steadily day and night. For five or six days they concentrate on bracing the trestles and clearing the river of timber and other debris that might threaten to knock out the piles in any of the railroad trestles. Two huge cranes are kept in constant operation ready to catch the passing trees and toss them onto the bank. However, in the summer of 1950 one huge fir, 60 feet long and 4 feet at the base, which the rushing waters had rooted up with perfect ease, was more than the cranes could handle. A tree of that proportion was a menace to the trestle pilings, and the debris that might accumulate among its branches could create still more trouble. The workmen solved the problem by cutting the tree up while it was in the water, and the cranes were then able to dispose of the smaller lengths.

The crew usually remains on duty for a few days after the flood has passed its peak on the chance that the Wonder Lady may send along a postscript.

After the lake has performed, it cannot gather strength to do so again until the glacier, moving slowly forward, impinges once more against the slope of the mountain.

Donald McDonald has aptly described the lake by comparing it with one of the intermittent dams used by the sourdoughs in Alaska to wash away the overburden in prospecting. In 1934 McDonald ranked Lake George among the wonders of the world and urged the Government to set the area aside as a reserve, park, or monument to protect the "wondrous lake and the game of the region." He predicted that such a reserve would become a mecca for tourists. Throngs would

Knik Glacier as seen from above the nik River floodplain. Lake George is ut of view to the right

Looking toward the head of Lake George. When full, the lake is possibly 15 miles long and about 4 miles wide at its big end. The beginning of the gorge that drains the lake is seen at lower right

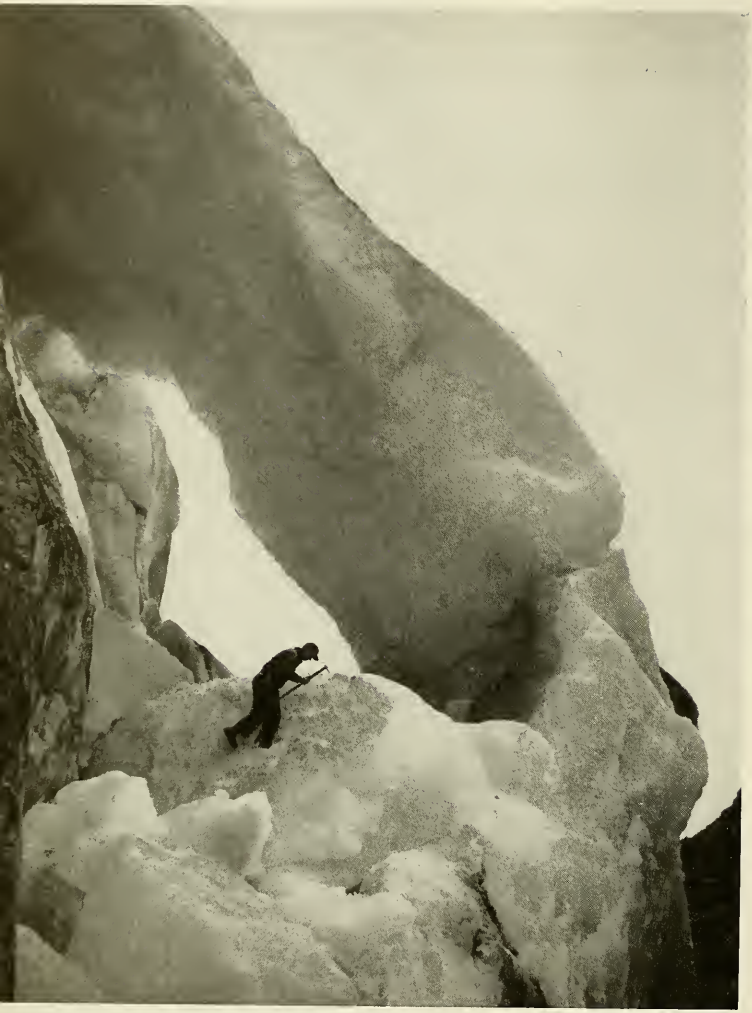


Photo by Don C. Knudsen

▲ ELABORATELY SCULPTURED ICE is seen where the glacier hugs the slope. One should not venture far in this chaos of ice without rope and crampons

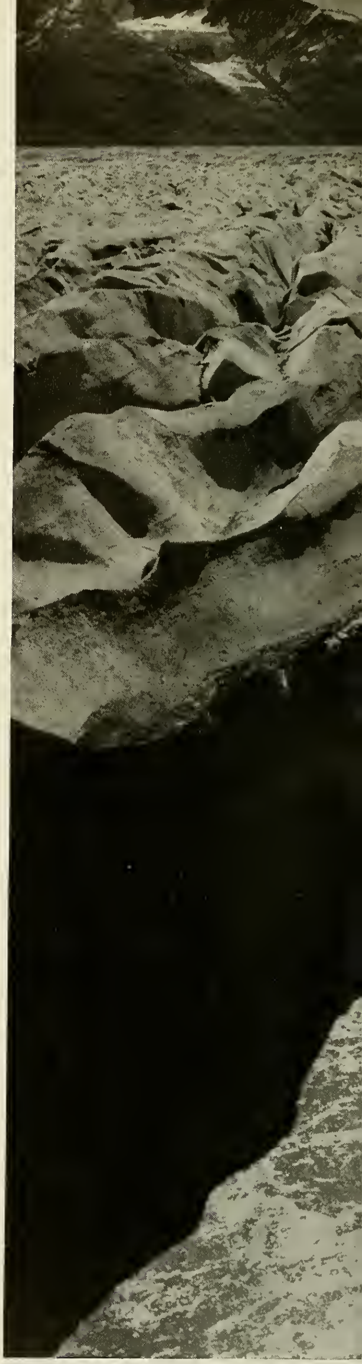


Photo by Don C. Knudsen

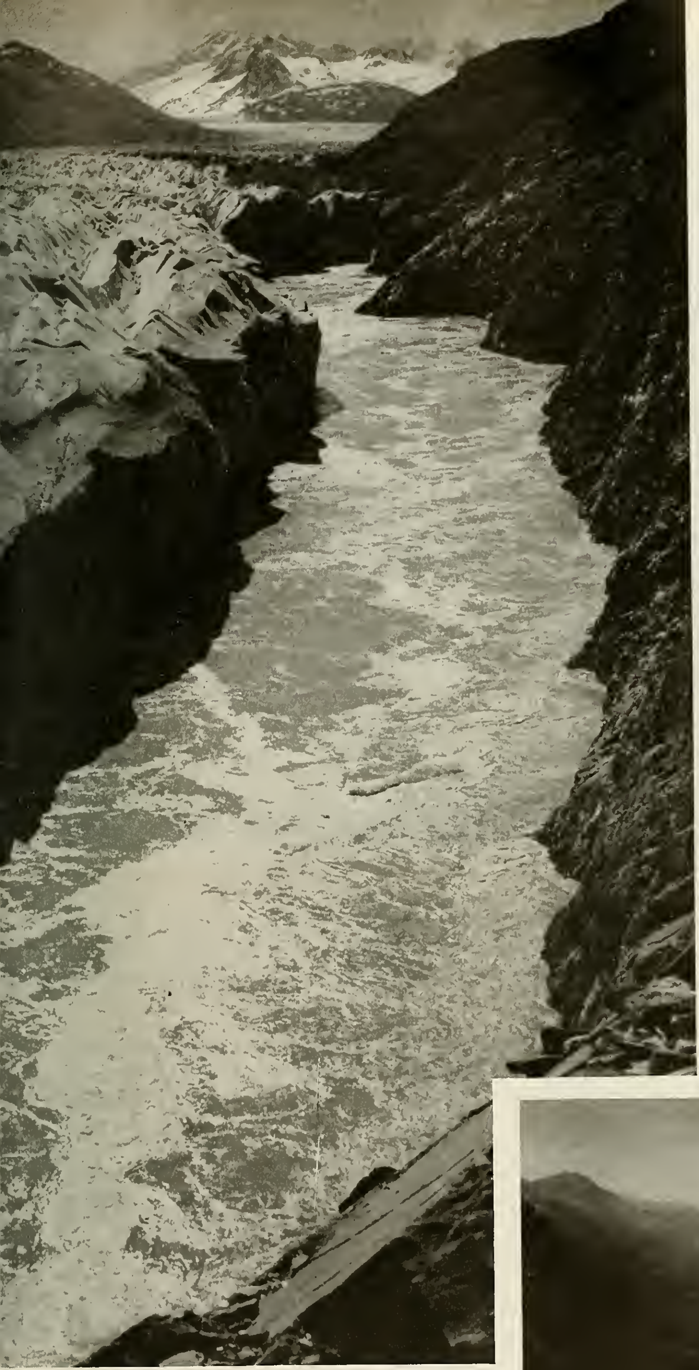
▲ HERE THE ICE WALL of the gorge is as high as a 15- to 25-story building. The river is about

gather, he said, to see the spectacular way in which Lake George pours out its contents.

This might be true if it were not so difficult to anticipate the time of the performance and if its work were not completed so quickly. Also we must realize that the few places from which the show can be watched to best advantage are hard to reach. It is difficult to get into the gorge because so much of the valley wall is steep and generally discouraging to travel. The slope is cut by streams that have to be crossed, and it is difficult, as in many other parts of Alaska, to thread one's way through the alders.

As befits such a prodigy of nature, Lake George has been under scientific observation. Dr. Kirk H. Stone, of the University of Wisconsin, has been making a special study of the region.

In its periodic nature and the grandeur of its display, Lake



George recalls Old Faithful. But quite different thermal principles control their actions. Old Faithful gets its strength from the rapid conversion of water into steam. Lake George, operating at the other end of the thermometer, breaks its bounds when ice is converted into water.

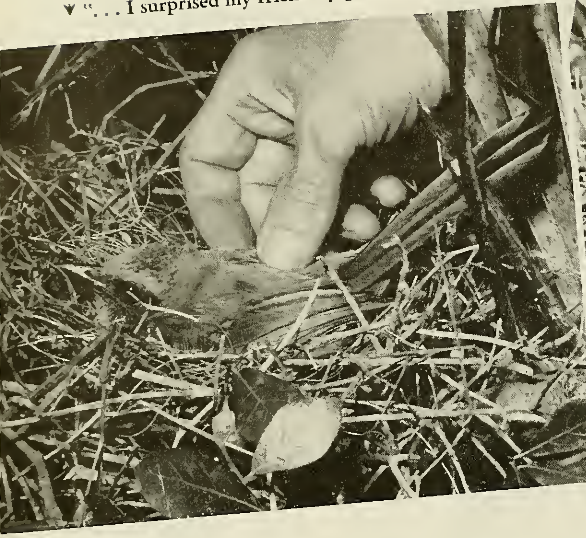
We cannot predict when a trail or road will lead to the gorge at the outlet of Lake George—any more than we can foretell each time when the lady will put on her act. But those who make their way to the snout of Knik Glacier at the right time will witness, according to all accounts, a memorable display. A deafening roar echoes through the chasm as huge pieces of ice join the mad melee to form a cataract that no man or beast could enter and survive. The water leaps scores of feet into the air, and the seasons seem at war. The glacier, having lost its ally, cold, is yielding to the pent-up strength of summer thaw. Within a day or so the game is won, and the earth may travel half a billion miles through space before the battle is joined again.

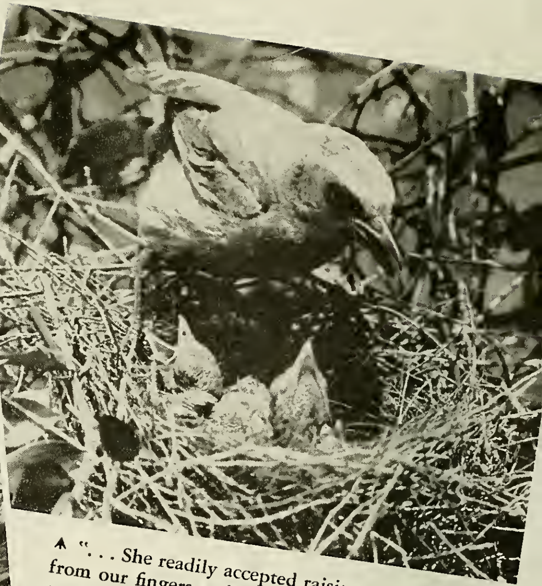
250 feet wide. Out of view in the background is Lake George. Down this flume its waters roar in a mighty flood when the ice dam gives way

▼ Flowing toward Knik Arm in the background, the waters from Lake George completely cover this floodplain at the time of the break-through. The flood sometimes endangers the highway bridge visible in this picture and also a series of railroad bridges that cross near the mouth of Knik River in the distance

Photo by P. W. H

▼ ". . . I surprised my friend by gently stroking the bird"





▲ ". . . She readily accepted raisins and bits of bread from our fingers and seemed not a bit ruffled by our maneuvers with tripod, focusing hood, and flash gun"

If you want to see how trusting a bird can be, present yourself to the Florida Jay. The mother bird may let you rearrange her for your camera and even stroke her when she is on her eggs

The Friendlies

By Hugo H. Schroder

All photographs by the author

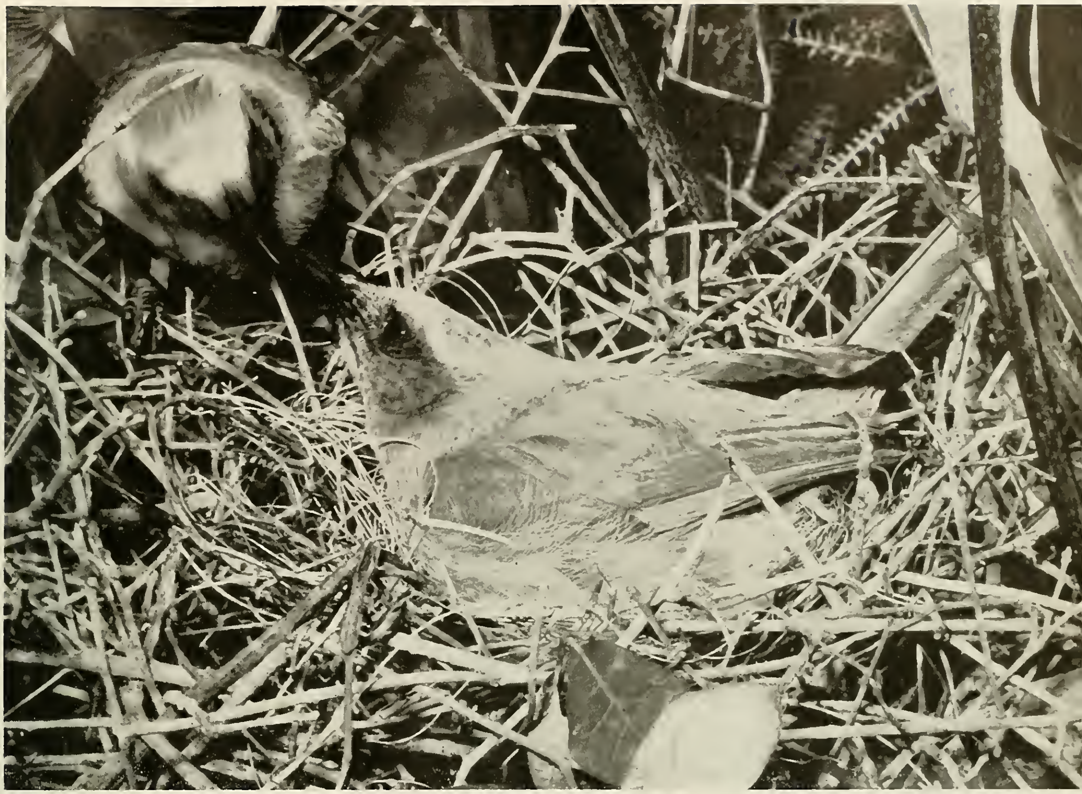
IN 1932, I had my first encounter with a Florida Jay at her nest, and the bird allowed me to stroke her back and even permitted me to pick her up and place her in a different position for a photograph. This convinced me that the Florida Jay is the friendliest bird I know. All my subsequent experiences as a professional bird photographer only serve to strengthen this opinion.

I returned to the nest a week after this encounter, when the young were almost ready to fly, and had difficulty keeping one of the smaller birds on the nest for a family portrait. Mamma Jay remained perched on the opposite rim of the nest for the exposure, and her only sign of disapproval was a slight ruffling of her feathers. When she hopped from the nest, she let me pick her up and put her back with her young. She uttered a few very soft, low-pitched notes as I held her. Her mate and the neighbors, however, were scolding me.

Later, on numerous occasions, Florida Jays have allowed me to stroke their backs on my first visit to their nests. Some years ago, I went with a friend to look for Florida Jay nests in a scrub region. John wanted Kodachrome movies, and he spotted the first nest. It was about at face level. While he was looking at the eggs, the female returned to cover them, astonishing him so much that he thought he was about to be attacked. But the bird had no such intention. She just wanted to cover her eggs.

When I came to view the bird, I surprised my friend by gently stroking it. I suppose he thought there was some secret in the way I did it, until he tried and likewise succeeded in stroking the bird without disturbing it.

During our visit to this nest, the female readily accepted raisins and bits of bread from our fingers. We were astonished to discover that two males who came to the nest took food from our fingers, and both fed the female. Here was a strange bit of bird behavior! Apparently there are triangles in birdland as well as among humans.



"Not one but two males fed the mother bird. They were more concerned about our presence than she was"

Bird I Know

I have had numerous similar experiences with other Florida Jays during the past nineteen years. Quite recently I photographed a female Florida Jay at her nest in an east Florida scrub area, where numbers of neighboring jays remained at the scene, all uttering frequent protests. But Mrs. Jay quietly went about her business. She allowed me to stroke her back and to pick her up and place her in a different position. There were small young in the nest at the time.

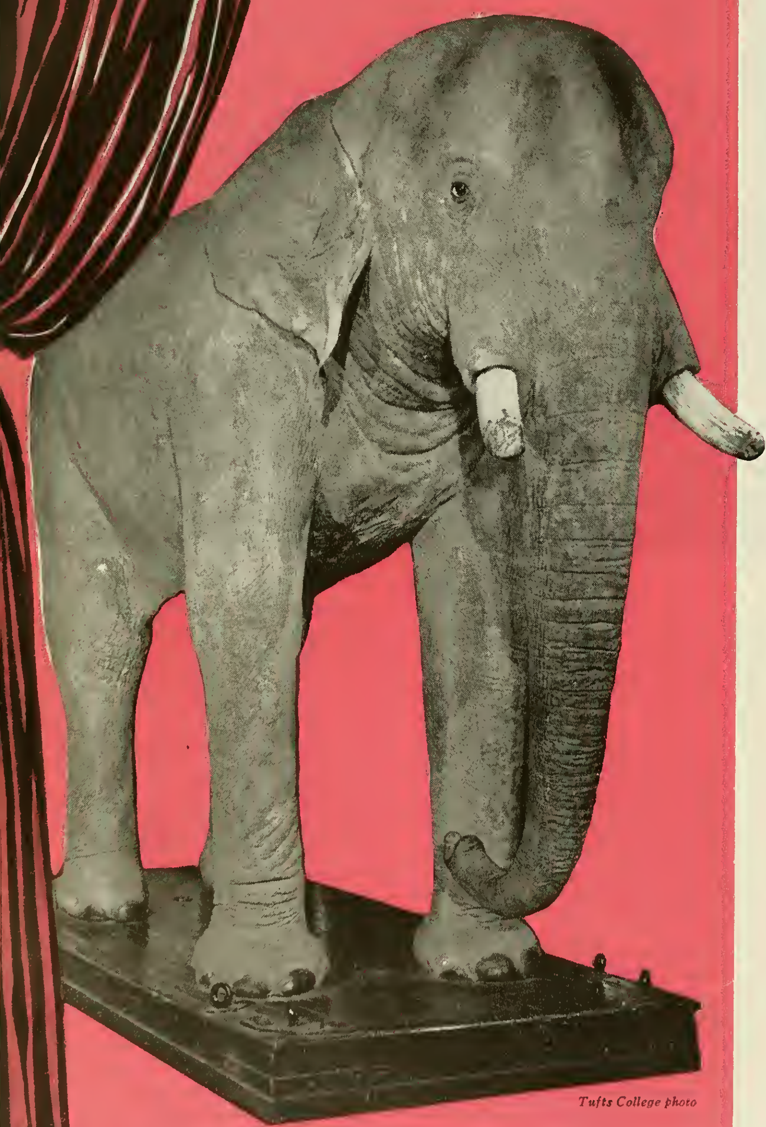
A week later I went back to secure color photographs, because those taken the week before had been underexposed. The female was on the nest and remained there all during my stay. Setting up the camera on a tripod, using a focusing cloth to get proper detail on the ground glass, arranging the flash gun, and firing the flash for each exposure—all this did not faze the female in the least. She took it all silently.

Her neighbors, however, came to protest vigorously as they had done the week before, except the male, who did not utter a sound. He just perched near the nest and watched the proceedings. Occasionally he joined the female on the nest, when he would allow me to place my fingers on his back, while I shot color flash photos of this unusual setup.

The male did take my finger in his bill several times, but it was not a real bite. It was a sort of half-hearted protest, as if he meant to advise me that I was carrying my attentions to his mate a bit too far.

Perhaps scientists will someday measure the jay's blood pressure or other physiological reactions and demonstrate that the bird feels more than it shows under circumstances of this sort; but to me the Florida Jay seems just plain friendly—or perhaps "trusting" is a better word. Other readers may recall experiences that demonstrate the peculiar friendliness of other species.

What Ever Becam



Tufts College photo

▲ JUMBO'S MOUNTED SKIN is now in Tufts College, where he stands 12 feet high at the shoulder and measures 18 feet around the body

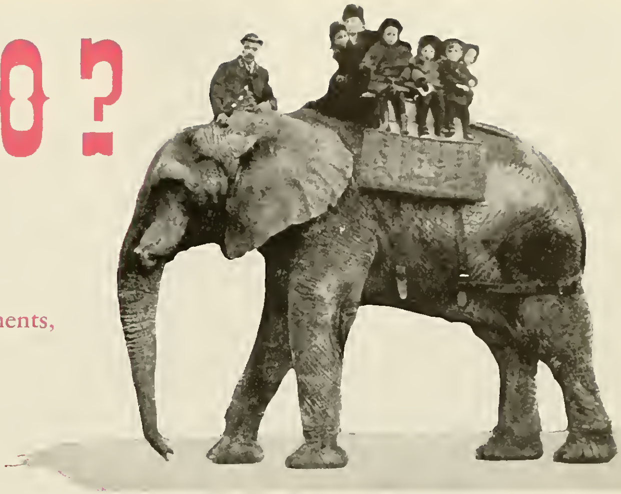
ALMOST 70 years have elapsed since P. T. Barnum, beaming with pleasure, shook hands with the Director of the Royal Zoological Gardens in London, closing the contract for the purchase of Jumbo. For the moment, the officials at the zoo showed similar signs of satisfaction. But they must have experienced a vague misgiving, a feeling that somewhere they had blundered. Was there a hitch in the transaction somewhere? The price certainly seemed excessive. Somehow it was all too pat and rosy to be safe, and Barnum seemed much too pleased with himself. But there were no loopholes left whereby the American could go back on his word—unfortunately for them. Not until that shrewd showman had the document securely buttoned up in his inside breast pocket did he let the news leak out that Jumbo, the darling of London's children, had been irrevocably sold for ten thousand American dollars. The shocking report of the sale burst like a bomb on the London public and echoed throughout the whole of Great Britain. Barnum, who understood human psychology well, played the publicity for all it was worth.

Jumbo had become a sort of national institution in England, to be zealously guarded, and the indignation of the British people was thoroughly aroused at the outrage. They protested angrily at the loss of their major attraction at the London Zoo and vociferously demanded that Jumbo remain to delight the English children. A fund was started by optimistic subjects to raise a ransom for Jumbo, and the Prince of Wales publicly condemned the transaction.

But all to no avail! Nothing short

f JUMBO?

King of elephants,
pet of thousands,
and friend of two continents,
he was beloved in life,
and we still thrill
to his dramatic career



▲ JUMBO'S greatest pleasure seemed to be in giving little children a ride on his back. This photo was taken in London's Royal Zoological Garden

By GEORGE G. GOODWIN
Associate Curator of Mammals
American Museum of Natural History

of death could separate Jumbo from the greatest showman of all time—not half a million dollars could buy him back. Even the intervention of the good Queen Victoria was politely but firmly rejected, and the matter came near to being an international issue. This, of course, only increased Barnum's determination to bring Jumbo to America. On his many visits to Europe, Barnum had often watched with envy the crowds that flocked to Jumbo's Court. He had been quick to recognize the tremendous drawing power of the great elephant. In terms of the circus, here was a fortune in "gate money" no matter what the animal cost.

Already Jumbo had brought a good $10,000 worth of publicity. Officials at the London Zoo, no doubt to justify their sale of the beloved animal, now claimed that Jumbo was subject to periodical attacks of bad temper. He had been extremely dangerous at times, they averred, and they never knew beforehand when he would be attacked by one of these fits. It was for this reason alone, they persistently claimed, that Jumbo had to be sold.

The British public reluctantly accepted the explanation but figured that the $10,000 had had something to do with it, and many probably hoped that the American authorities would object to the admission of the so-called dangerous elephant to our shores. Barnum explained tactfully to the irate British that Jumbo was not a native Londoner and that American children should not forever be denied the privilege enjoyed by English children for so long. He smilingly added that he would have his 14,000 pounds of flesh if there was a law in the land.

Through Barnum's shrewd manipulation, Jumbo's fabulous career was made then and there in London by the unsuspecting English people. Jumbo became the greatest attraction in show business that the world has ever known. In the three years he toured America, he earned for his owners considerably more than a half a million dollars *net profit*.

After much coaxing and prompting, Jumbo permitted himself to be hoisted on board the "Assyrian Monarch" on March 24, 1882. His faithful companion and keeper, Matthew Scott, was constantly at his side during this trying ordeal and helped to overcome Jumbo's nervousness. Scott, probably with his tongue in his cheek, told reporters at the time that Jumbo was accustomed to his "daily bucket of beer" and that on occasion of illness "two gallons of whiskey" were a normal dose for the great creature.

Many of Jumbo's friends and admirers – some of them among the ranks of nobility—visited him on board and brought farewell gifts of fruit, cakes, and even champagne and oysters. Scott was himself a teetotaler, and in his own published account of Jumbo he wrote: "Jumbo is a great 'teetotaler,' and if my temperance friends want a powerful illustration of a good healthy, strong, and most powerful frame that practiced habits of temperance . . . they may refer to my Jumbo as a specimen."

Jumbo in the American Circus

Jumbo landed in New York on April 9, 1882, after an uneventful though rough voyage, and seemed none the worse for the trip across the Atlantic. From the docks Jumbo was escorted in typical circus style up Broadway, accompanied by a brass band and nautch dancing girls "with their original queens," to Madison Square Garden. Here he began in earnest his career in show business.

The cost of Jumbo to Barnum with transportation charges had now risen to $30,000. But during the first ten days of exhibition he more than earned his cost. It has been stated that Barnum was at one time offered $100,000 for Jumbo but declined it.

For three years Jumbo traveled through the United States and Canada with Sangers Royal British Menagerie and Grand International Allied Shows—Barnum, Bailey and Hutchinson, the sole owners. Jumbo showed no signs of the dangerous proclivities ascribed to him at the time of his purchase.

Jumbo's daily food ration now consisted of 200 pounds of hay, two bushels of oats, a barrel of potatoes, from ten to fifteen loaves of bread, and two quarts of onions.

Barnum trumpeted Jumbo as "the universal synonym for all stupendous things." Although Jumbo towered nearly eleven and one-half feet in height at the shoulder, he was not tall enough for P. T. Barnum, whose gaudy posters showed how easily the great beast could take peanuts offered from third-story windows.

Soon Jumbo's popularity rose to as high a pitch with the American people as it had reached with the British public. At the end of three years, more than a million American children had climbed on Jumbo's back and enjoyed a ride. There seemed every reason to suppose that for many years Jumbo would bring joy to circus goers and a substantial profit to his owners. Admittedly, he knew no amusing tricks like other elephants, but this was not due to any lack of learning ability—he simply hadn't been taught any. Such frivolous exercises were below his dignity. As befitting one of the great dignitaries, Jumbo now rode the tracks in his own private car, "The Palace Special."

The fact that death must at sometime overtake the noble creature was not entirely overlooked. Professor Henry A. Ward, whose Natural Science Establishment was adjacent to the University of Rochester campus, received the following letter from the circus headquarters at Bridgeport, Connecticut, dated October 9, 1883. "Dear Sir: On my return home I found your letter of August 29. I shall have my managers understand that if we lose Jumbo (which Heaven forbid) you must be telegraphed immediately, and I hope you will lose no time in saving his skin and skeleton. As to the other animals, I will talk with you about them at the close of the season—a fortnight hence. Truly yours, P. T. Barnum."

Jumbo Dies in Middle Age

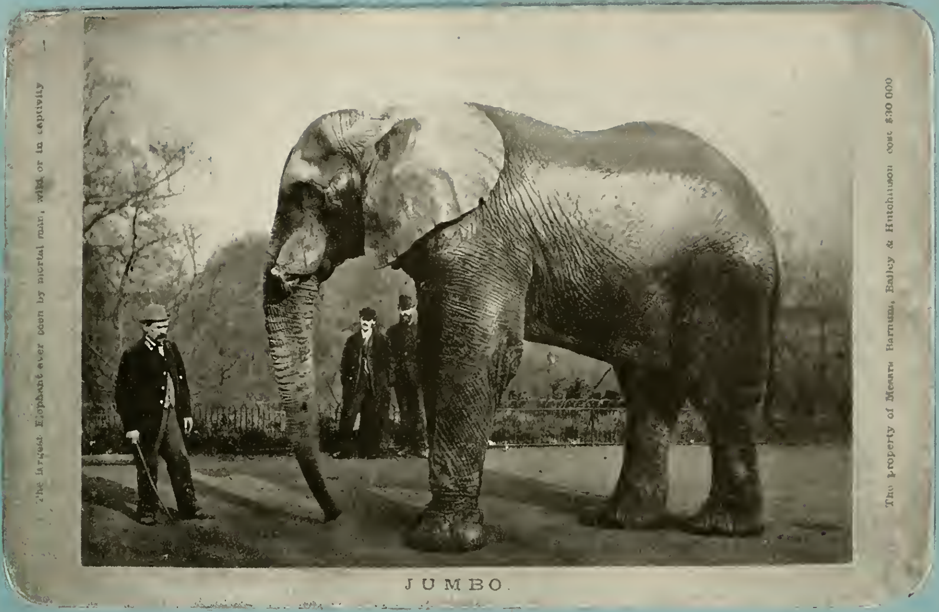
Evidence gleaned from Barnum's letters about this time indicated that Jumbo had been ailing for some time and that his days were numbered. But no one dreamed of the tragic death that finally drew the life of the great creature to an abrupt end. Every newspaper throughout the entire world carried news of the tragedy.

"Jumbo has been killed!" were the words that flashed over the wires to every corner of the earth on that eventful night, September 15, 1885. It has often been reported that Jumbo lost his life through the negligence of a small boy entrusted with a message regarding the time of the arrival of the train that struck and killed the elephant. The boy, it seems, stopped on his way to the circus grounds to join in a game with other boys and completely forgot the message entrusted to him until it was too late. In the meantime, at the freight yards at St. Thomas, Ontario, most of the circus animals had been loaded on the train, including 31 elephants. All that remained were Jumbo and Tom Thumb, a clown elephant—the two most prized animals of the show. As the two elephants were being brought alongside the railroad cars, the whistle of a locomotive gave warning of a fast approaching express freight. The now frantic circus men strained every effort to coax the two elephants to safety through a gap in the fence alongside the tracks. Scott called, "Run Jumbo, run." The great animal responded quickly and started back but passed the opening in the fence. Realizing this too late, he turned and started to retrace his steps toward the oncoming train. A flagman tried in vain to stop the train by waving his red lantern. The engineer, W. Burnip, saw the animals in the rays of his headlight, but it was too late. Though the wheels were locked and sparks flew, nothing could halt the impetus of the express freight, now on a downgrade. The engine, No. 88 of a Grand Trunk train, crashed into Jumbo.

Accounts of the accident say that Jumbo, with true animal instinct, appeared to realize the danger, and it was said that he uttered a roar such as never before had been heard by his keeper. There was a

A.M.N.H. photo

▲ THE AMERICAN MUSEUM fell heir to Jumbo's massive skeleton, which enthralls thousands of visitors each year


The largest Elephant ever seen by mortal man, wild or in captivity
The property of Messrs Barnum, Bailey & Hutchinson cost $30 000
JUMBO.

E. Bierstadt photo

▲ **JUMBO** was sold to P. T. Barnum for $10,000 by the Royal Zoological Gardens in London. The Director thought he had made a shrewd sale until the British public heard about it. Jumbo was almost a national institution

crash when the animal and the engine met head-on, and the mighty Jumbo was brought to his knees. The baby clown elephant was thrown into the ditch with a broken leg. The engine and several cars were derailed by the impact.

The newspapers reported that "Scotty," Jumbo's keeper, cried like a child. This was probably Matthew Scott, who had come from London with Jumbo. There was nothing so especially tragic about the accident, but by the time Barnum had publicized his colorful version of the elephant's death, half the nation was in mourning and the other half clamoring for a memorial to be erected for the dead animal.

With the assistance of hundreds of circus people, Jumbo's body was removed from the tracks, and preparation was made to send the animal to Ward's Natural Science Establishment. Barnum did have some sort of arrangement whereby his losses were sent to the United States National Museum, but an exception was made of Jumbo.

It took two days to dissect Jumbo. A policeman had to be put on duty night and day to guard against a hoard of morbid souvenir hunters who greatly impeded the task. In a souvenir program of Billy Rose's "Jumbo" at the New York Hippodrome in 1935, there was an eyewitness account of the dissection, as follows: "Frank C. Golding . . . who had been employed to collect the preservatives and other materials, is also still living at St. Thomas, and he informed the writer that Peters, who did most of the 'inside' work had to come out from Jumbo's interior every few minutes, 'looking pretty white around the gills,' to get a breath of fresh air. Peters afterwards said he realized what Jonah must have gone through inside the big fish.

"'There was a hatful of English pennies and a half crown in Jumbo's gizzard,' relates Mr. Golding. There were rivets, pieces of wire which had probably been used to bale his hay, trinkets of all kinds, glass ornaments, a bunch of keys on a ring, a policeman's whistle, and what not. Mr. Golding and others got the coppers for souvenirs. People tried to rush in and get pieces of the hide with their knives, also pieces of ivory from the tusks. One small boy managed to take a chunk off one of the ears. and when Scott saw what had been done he wept with rage."

In the lawsuit with the railroad that followed, Barnum claimed that Jumbo's death meant a loss of at least $100,000 in gate money. However, the case was settled out of court for $10,000 in cash and free transportation on the railroad for the circus for one year.

One of Barnum's flamboyant descriptions of the death of Jumbo reads as follows: "The leviathan of the rail and the mountain of bone and brawn came together with a crash that made the solid roadbed quake. The heavy iron bars of the engine's pilot were broken and twisted as if they had been grapevines, and its front stripped as by an explosion of dynamite. With his mighty tusks driven clean back into his brain and his massive skull crushed in, Jumbo . . . gave but one groan after being struck and then assumed an attitude of determination and composed himself to meet death with a becoming dignity and fortitude."

One version of Jumbo's tragic death claims that he lost his life while trying nobly to rescue the little elephant, Tom Thumb, from the front of an oncoming express train, or as Barnum aptly put it: "Jumbo sacrificed his own life to save that of Tom Thumb, a pygmy elephant." Jumbo, so the great man said "had snatched the little elephant from in front of the thundering train and hurled the little fellow twenty yards to safety."

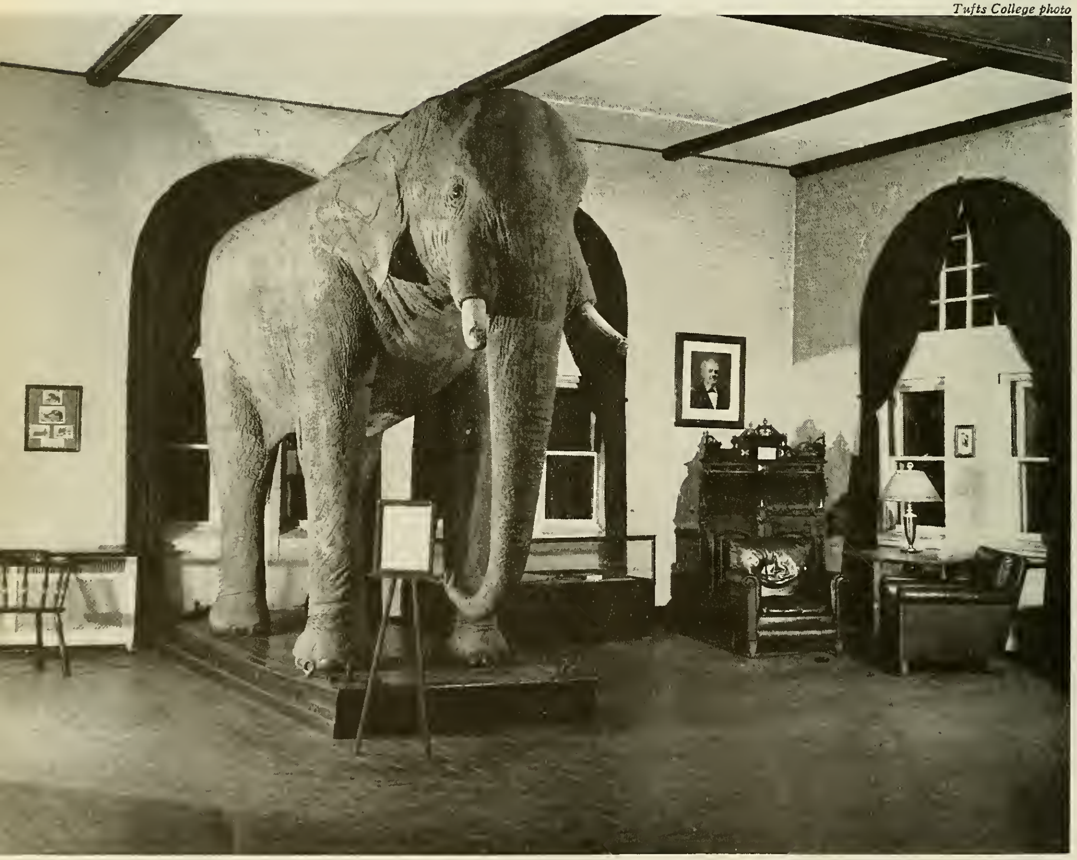
A Monument to the Memory of Jumbo

Professor Henry A. Ward undertook to have Jumbo's skin and skeleton mounted at the Natural Science Establishment in Rochester and estimated a minimum price of $1200 for the job. He figured it would require about two months to do the work, but it actually took six. A special building had to be erected for the undertaking. Barnum's instructions in regard to mounting the skin were, "By all means let that show as large as possible. It will be a grand thing to take all advantage possible in this direction! Let him show like a mountain."

Jumbo's hide weighed 1538 pounds and his bones 2400 pounds. The task of mounting a full-grown elephant was an enormous undertaking for a taxidermist in those days and required considerable planning. At the age of 19, Carl E. Akeley, who later became famous as the genius behind Akeley African Hall at the American Museum, participated in the work, in collabo-

▼ TRADITION HAS IT at Tufts College, where Jumbo is the official mascot, that coins dropped into his trunk bring "A" marks on exams

Tufts College photo



ration with W. J. Crutchley. This was the Carl Akeley who later revolutionized taxidermy, raised it to the rank of sculpture, and invented the Akeley motion-picture camera. Akeley never lived to see his dream of an African Hall completed, but he mounted the Hall's famous group of African elephants, the greatest feat in modern taxidermy. His masterpiece was the great bull in the center; and the cow elephant in the exhibit was shot by none other than Theodore Roosevelt. Akeley knew his elephants in their natural state and ably instilled that knowledge in his work. Of his experiences in Africa, he once wrote "When I caught sight of them they had gone about fifty yards and had stopped. And then I did learn something about elephants. My old bull was down on the ground on his side. Around him were ten or twelve other elephants trying desperately with their trunks and tusks to get him onto his feet again. They were doing their best to rescue their comrade." *

When Akeley had completed the work on the mounting of two Jumbos—one the stuffed skin and the other the skeleton—Barnum and Ward made the unveiling an occasion for a great publicity stunt. They set the date for February 26, 1886. His press agents invited all available reporters for the big spread, which was to be held at the Power's Hotel. About a pound and one-half of Jumbo's tusks were ground into a fine powder and used in preparation of a composition jelly. This unique dish was served to the guests—so the reporters not only saw Jumbo and heard Barnum and Ward speak eloquently about him but took him internally too. Thin slices of Jumbo's tusks inscribed as souvenirs were given to a favored few of the guests.

Although there was a big turnout and everyone enjoyed the party, it proved a great disappointment to Barnum. Somehow word of the event leaked out and premature publication by one paper killed it as news for the others. Barnum, though greatly annoyed, did not blame Ward for letting the news get out. A notation in Ward's diary under the date of March 4, 1886, reads: "Jumbo – stuffed skin and mounted skeleton – left today for Bridgeport." For two years both mounted skin and skeleton accompanied the circus on its annual tour through the states and Canada.

Jumbo is now in College

P. T. Barnum was a trustee of Tufts College at Medford, Massachusetts, and the mounted skin was placed in the Barnum Museum on the college grounds. Four years later Barnum took Jumbo back and sent him on a tour of England. However, he was restored to the college in 1890, where he has been ever since. Students at Tufts College now regard Jumbo as the school's official mascot. College tradition has it that coins dropped into Jumbo's trunk before an examination will bring an A mark more easily than an all night's session of cramming. The mounted skin of Jumbo stands 12 feet high at the shoulder and measures 18 feet around the body.

In the Halls of the Mighty

Jumbo's skeleton was sent to the American Museum of Natural History in 1889, where it is still on exhibition. It was given the catalogue number 3283 and now stands in the Synoptic Hall on the third floor of the main building, in company with the great Blue Whale, largest of all creatures that ever lived on the planet. The skeleton stands eleven feet, one and three-quarter inches high at the shoulder. Its limbs are now polished and grimy from the little hands of thousands of admiring children that have fondled it during the past 62 years. Jumbo's heart, advertised at $40, was sent to Cornell University, Ithaca, New York. What were supposedly Jumbo's tusks were sold along with the effects of John Ringling's New York house on January 15, 1940. An attorney for the family bought the tusks for $85 after a spirited bidding by a dozen persons. That these were Jumbo's original tusks is questionable. They were probably a movable pair used on Jumbo's skeleton during the two years it was on tour with the circus and not included with the skeleton when it was presented to the Amer-

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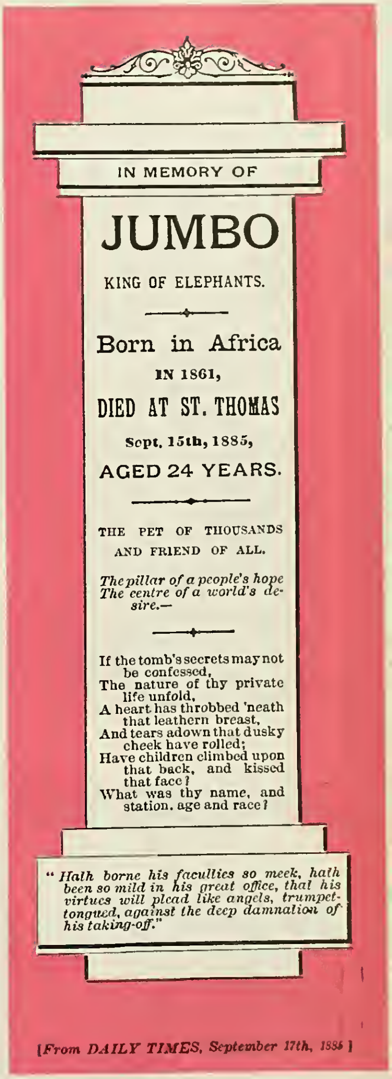

IN MEMORY OF

JUMBO

KING OF ELEPHANTS.

Born in Africa

IN 1861,

DIED AT ST. THOMAS

Sept. 15th, 1885,

AGED 24 YEARS.

THE PET OF THOUSANDS
AND FRIEND OF ALL.

The pillar of a people's hope
The centre of a world's desire.—

If the tomb's secrets may not be confessed,
The nature of thy private life unfold,
A heart has throbbed 'neath that leathern breast,
And tears adown that dusky cheek have rolled;
Have children climbed upon that back, and kissed that face?
What was thy name, and station, age and race?

"Hath borne his faculties so meek, hath been so mild in his great office, that his virtues will plead like angels, trumpet-tongued, against the deep damnation of his taking-off."

[*From DAILY TIMES, September 17th, 1885*]

▲JUMBO'S OBITUARY published in a newspaper of the day, Sept. 17, 1885

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* Quite by accident and apparently unnoticed, the recent motion picture *King Solomon's Mines* captured this action on film. No mention is made of the significance of this lucky shot, and most spectators will not notice it, but the alert cinema-goer will thrill to this dramatic vindication of Akeley's original observation—Ed.

Winter Wonders

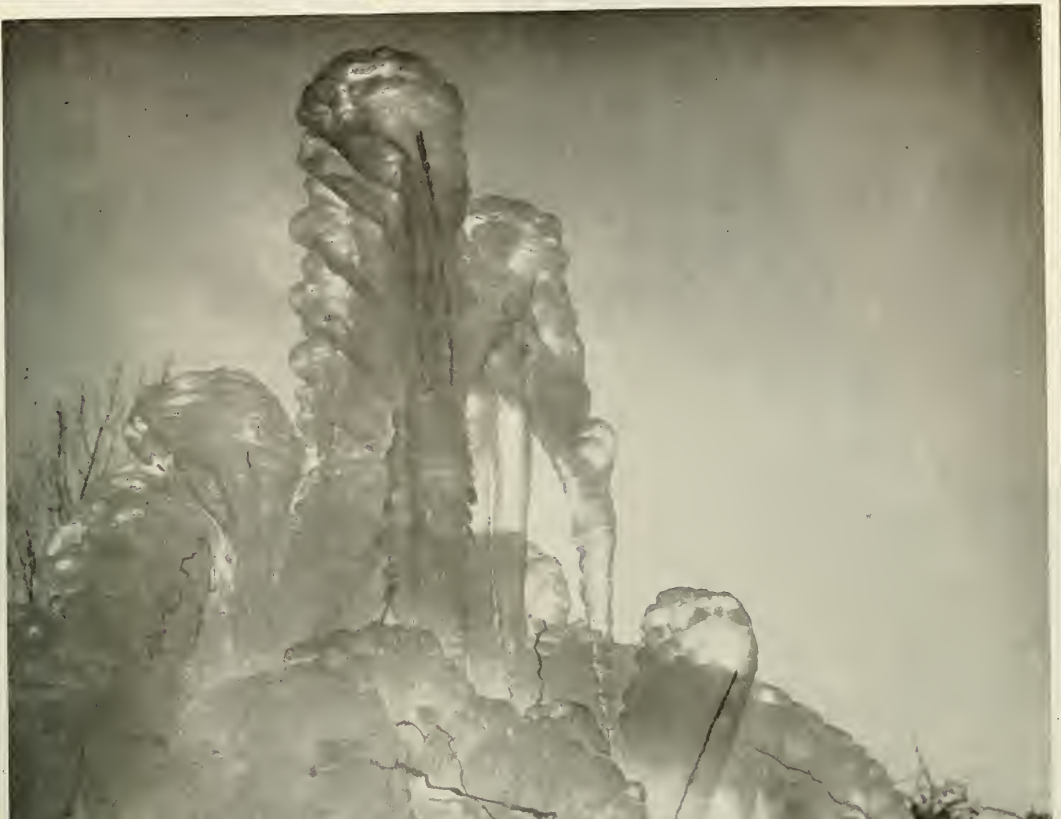
A photographic display

By R. M. Milo

An ice-girt causeway to a lonely beacon

South for the winter, no forwarding address

Like Halloween goblins caught working overtime and frozen stiff

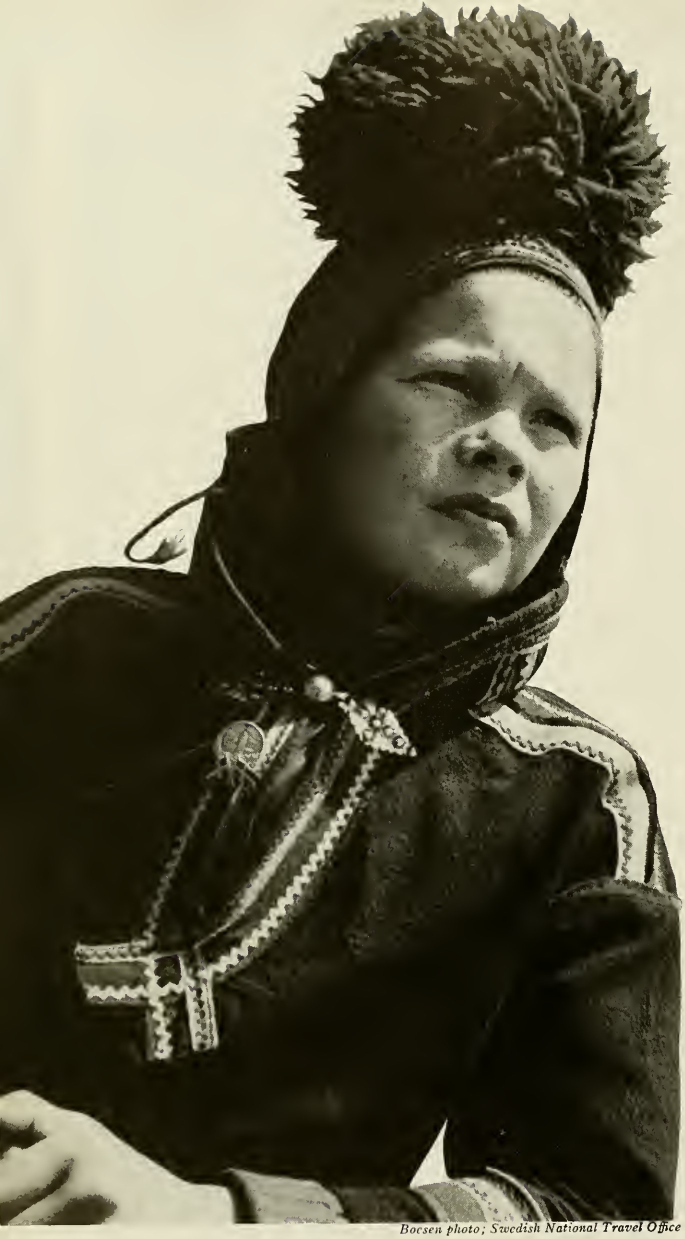


Effigies in ice, elephants, mantises, and anteaters. Their skeletons—last autumn's fragile twigs

Arctic

By **Irene Morden**

FOR thousands of years the Lapps have herded their reindeer across the top of the globe. Early explorers in those Scandinavian lands that lie above the Arctic Circle returned from their arduous



Bocsen photo; Swedish National Travel Office

▲ A LAPP BOY. Neighboring racial strains have to some extent contributed to the ancestry of the modern Lapp

➤ THE LAPP'S homeland is a world of mountains, lakes, and rivers, largely north of the Arctic Circle. The Lapps are believed to have come originally from Asia, and they retained much of their cultural independence down to recent times

Nomads

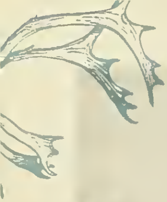
A glimpse into the life of the Lapps—a people whose very
ence is determined by the reindeer they follow through the wilderness of the far north

journeys to tell fantastic stories of a wild people who dressed in animal hides and spoke in a strange tongue. They had met the legendary Lapps.

The first contacts of those visitors from the outside world with the isolated Lapps proved conclusively that these nomads of the Arctic were in occupation centuries ago. Yet today, in spite of a long tenure in the far north, there are only about 33,000 Lapps left in the entire world. Two-thirds of them are in northern Norway. Some 7000 live in Sweden. The others are scattered throughout northern Finland and Russia.

Always associated in men's minds

Courtesy of Scandinavian Airlines System



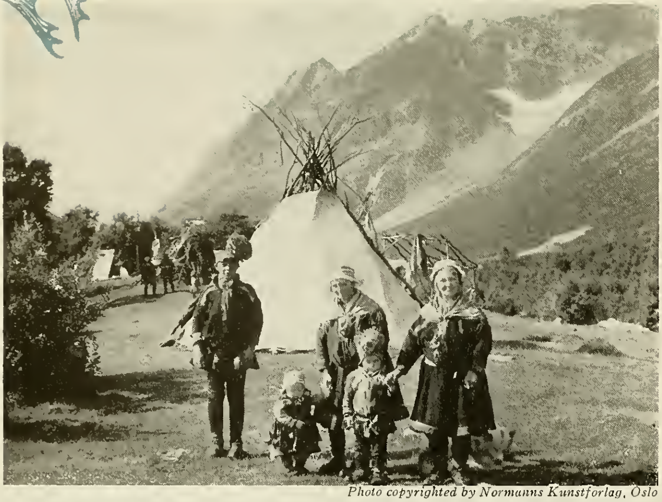


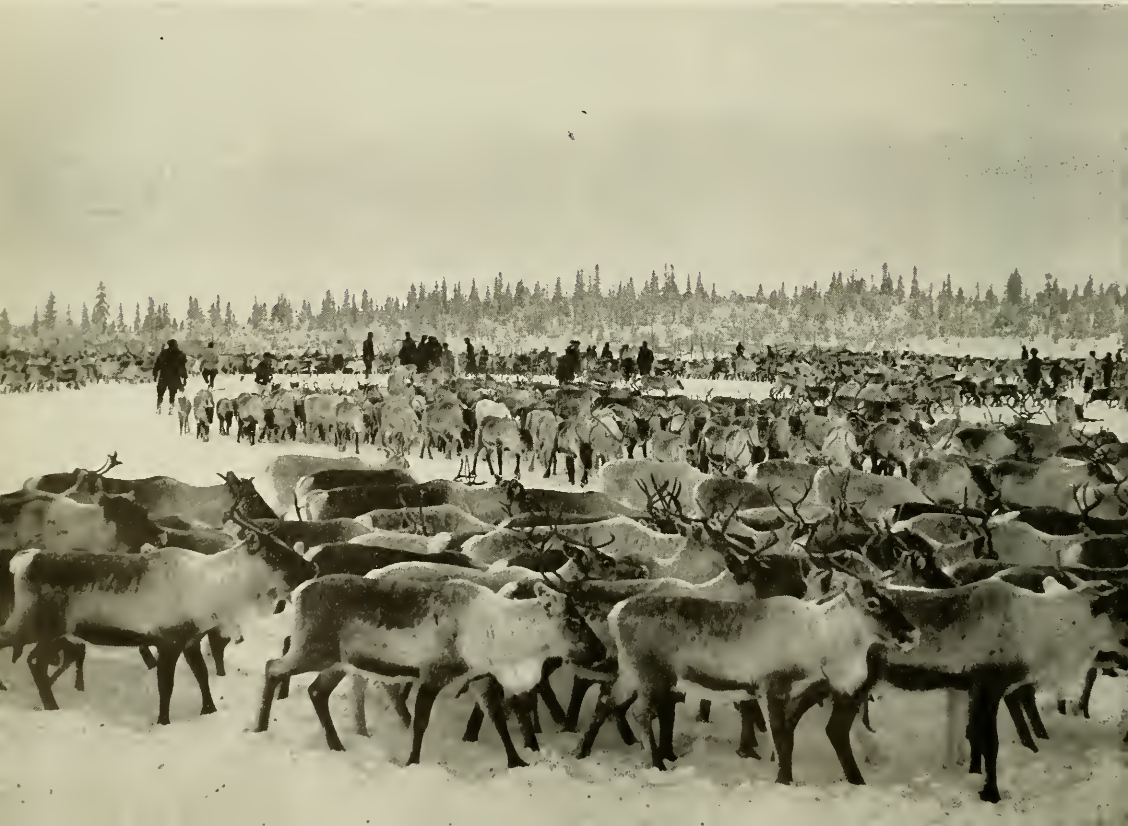
Photo copyrighted by Normanns Kunstforlag, Oslo

↑ A CAMP of Norwegian Lapps at Lyngseidet: a summer scene amid the sweeping mountain grandeur that characterizes some of their territory

with the Lapps, and rightly so, is the reindeer. This large Arctic animal, member of the deer family and kin to our North American caribou, has branching antlers, a dense brown coat, and white tail patch. It has been domesticated by the Lapps. The Lapp economy—indeed their whole way of life from time immemorial—has been conditioned and formed by the reindeer. Lapps are nomads. Why? Because the herds of reindeer are continually on the move, seeking the lichens and mosses upon which they subsist. In consequence, this Arctic people has spread over a wide range of pasturage. As the Lapps follow their herds seasonally over the ancient tracks and trails of this bleak wilderness, they use the reindeer as their Arctic "pack horse." It drags the sleds over the hard snow crust. On its back may be the bundled tent and all the crude paraphernalia of the camp. Although a reindeer can carry a reasonable load, its

↓ REINDEER ROUND-UP. The different herds are sorted, and the animals are branded with the owner's mark. This view is in Swedish Lapland

Courtesy Swedish National Travel Office



Courtesy Swedish National Travel Office Bureau

▲ Rodeo games, Lapp-style: boys practicing with their lassos

back is not too strong, so it is never ridden except possibly by children.

It is his herd of reindeer that constitutes the Lapp's wealth. The number he owns represents his kroner on the hoof rather than in the bank. The indispensable creature provides the excellent steaks, the rich soups, and the milk and cheese of the Lapp diet. Neither horns nor hides are wasted. The horns are used for handles to knives and for spoons and other implements. The skins provide "fur" coats, shoes, and gloves—much of the clothing that keeps the Lapps warm throughout the long, dark Arctic winter. Even the small bit of skin from the forehead of the reindeer, where the hair grows out in all directions, is used for the heel of the *komag* or winter boot, as it does not slip on the ice. Shoes and clothing are sewn with thread made from reindeer sinews.

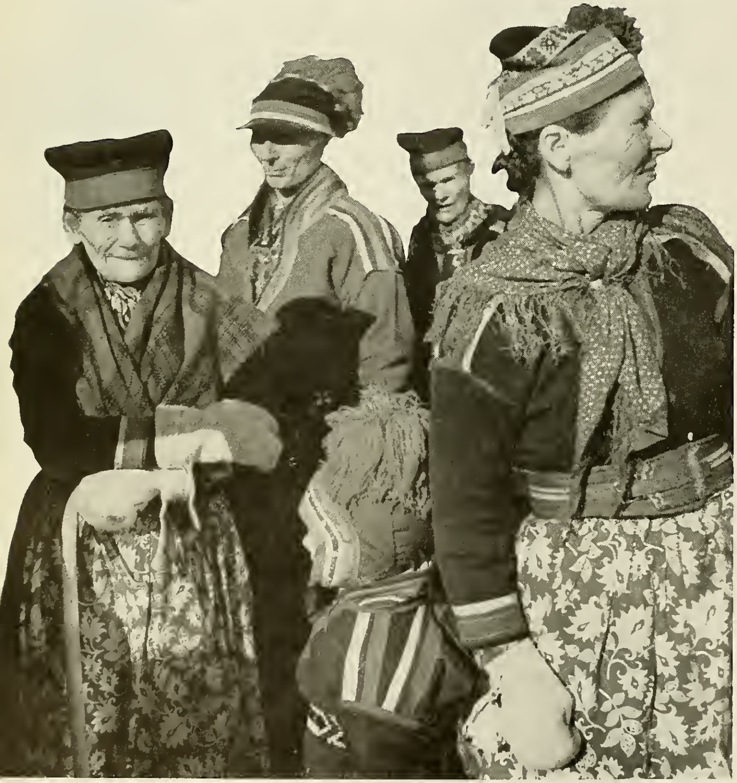
While most of the Lapps still rove the mountains and the plains, some have become resident in parts of Norway and Sweden. They tend to live in small communities, but there are some villages with permanent cabins used as market centers and seasonal meeting places for both resident and nomadic Lapps. In these villages trade is carried on, courts are held, church services conducted, weddings solemnized, and babies baptized. They also have some dormitory schools for Lapp children. Two such villages, Karasjokk and Kautokeino, razed by the Germans in the late war, are being rebuilt. But just as they had been from time immemorial, the Lapps we visited in northern Norway were living in easily constructed tents or tent-shaped huts. Imagine for yourself a crude shelter supported by irregular birch poles, not unlike the tepee of the American Plains Indian. You step inside. For a moment you are blinded and choking with the acrid smell of smoke. At the center, on hearth stones set in a depression, a little fire burns. The theory is that the smoke rises to escape through the wide opening at the peak of the tent. This is only a theory. Until you sit or lie down you are uncomfortable. Once down, however, the smoke rises above eye level and you are able to look about the dim interior of the tent.

Being guests, we were offered small boxes to sit upon, the Lapps reclining the while on reindeer skins thrown over thick layers of twigs, which serve as protection from the hard, bare earth. We conversed through our Norwegian interpreter and with the aid of gestures and smiles. It was amusing to watch the sturdy Lapp housewife prepare a meal. So small was she that she could move about freely while preparing the food without risk of being suffocated by the acrid smoke. Her pans and spoons hung conveniently near on sticks. On the hearth stood the omnipresent coffeepot (Lapps love coffee) and her burnished copper kettles. Hanging from poles overhead were dried fish and reindeer meat in the process of being smoked and cured for later consumption. It has been said that Lapps eat all the time. True or false, though the Lapps are well nourished, they are rarely fat to the point of obesity. Perhaps this is because meat forms the large part of their diet, although edible berries and fish may be eaten.

To one side in this cozy family gathering were grouped the children, playing quietly with a friendly black-and-white dog. Later we noticed that the Lapps hobble their dogs by tying a piece of wood around their necks. This is to prevent their running away, for the dogs are of the greatest utility in herding reindeer. Well-trained dogs of the Spitz type guard the herds. It is unlikely that the Lapps could manage without the faithful canines to help them on the trails and during the days of the reindeer roundup when reindeer are earmarked by their owners.

The Lapps are a proud people. We were warned by our interpreter that they would feel insulted if a gratuity were offered to them. Souvenirs, however, proved to be another matter, and no sooner had we made known our interest in their handiwork than the lady of the tent produced a box full of the family's handicraft. Here were reindeer boots with their curiously curled-up toes trimmed with red felt and wool pompons, knives with reindeer-horn handles, dolls authentically accoutered in Lapp costumes, and even a miniature baby cradle made of a hollow piece of wood covered with reindeer skin decorated with red, yellow, and blue felt and lined and padded for comfort. These and more we came away with.

The Lapp is a singularly picturesque fellow. Generally he is small, ranging to little more than five feet, and the women are even more diminutive than the men. Given to gay colors, their fabrics of red, green, and bright blue are decorated with ribbons, bits of colored wool, and wool or metal thread embroidery. In winter the outer garments are of reindeer skin, or the Lapp may simply wear one tunic on top of another. The tunics are trimmed with bands of red and yellow felt caught in at the hips by belts of leather or woven wool, below which the end flares out in skirtlike fashion somewhat longer in back. Both men and women wear narrow trousers that reach to the ankles. These are slightly wrinkled above the knees but fit more tightly below, giving their



Courtsey Swedish National Travel Office

◄ WINTER AND SUMMER, the Lapps are at home in the out-of-doors. Here again is evidence of the racial mixture that has affected the Lapps in modern times

Courtesy Norwegian Travel Information Office

▲ "**When the wind blows . . .**" A Lapp mother and her baby in a special Lapp cradle

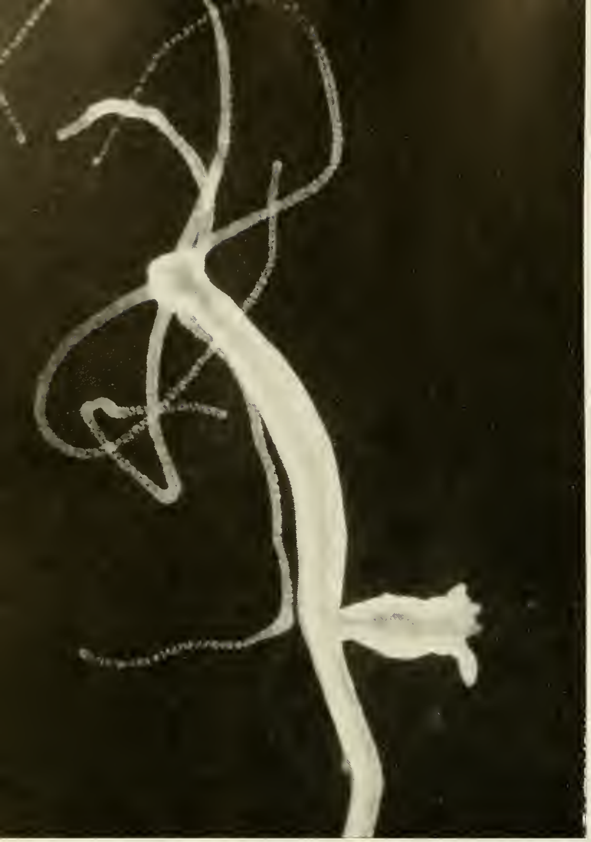
rather bandy legs the effect of wearing jodhpurs. There is the inevitable reindeer boot with those curiously curved-up toes. For comfort the boots are padded with soft sedge grass. Long, colored ribbons are used as shoelaces and, attached to the shoes, are wound upward about the calf of the leg. Some Lapps wear boots with soft shoe bottoms of ox leather, just as some of them have come to wear our modern cloth caps. But, when quaintly caparisoned in dress that dates back to the Middle Ages, they present, with their peakless conical caps decorated with wool pompons and pulled down over one ear, an unforgettable picture.

Of unknown origin, the Lapps have to some extent intermingled with the Norwegians, Swedes, Finns, and Russians. Many admixtures are now characterized by the dark coloring, round skulls, and short stature of the Lapps. Interbreeding has changed some Lappish habits, too, but it has not lessened their amazing powers of endurance or diminished their love for the north country. Through the sunlit nights and the dark days—the short glory of the Arctic summer and the long gloom of the Arctic winter—just as did his ancestors before him, the northern Lapp today wanders in the paths taken by his vast herds of reindeer. He roams back and forth through the mountain passes, seemingly contented with his lot. A singularly simple and primitive existence it is, and this is particularly apparent when the casual wayfarer among them, as we were, compares their lot with the comforts and gadgets that fill one's life in western civilization. How long will it continue to be so in Lappland, that "country of no frontiers"?

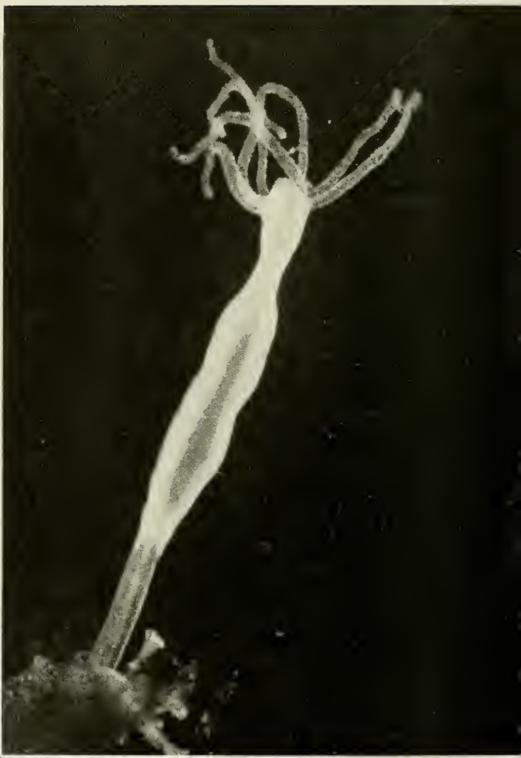
▼ **The Lapp sleigh** is shaped like the front half of a boat. The reindeer that draw it are not strong enough to be ridden

Courtesy Finnish Tourist Association

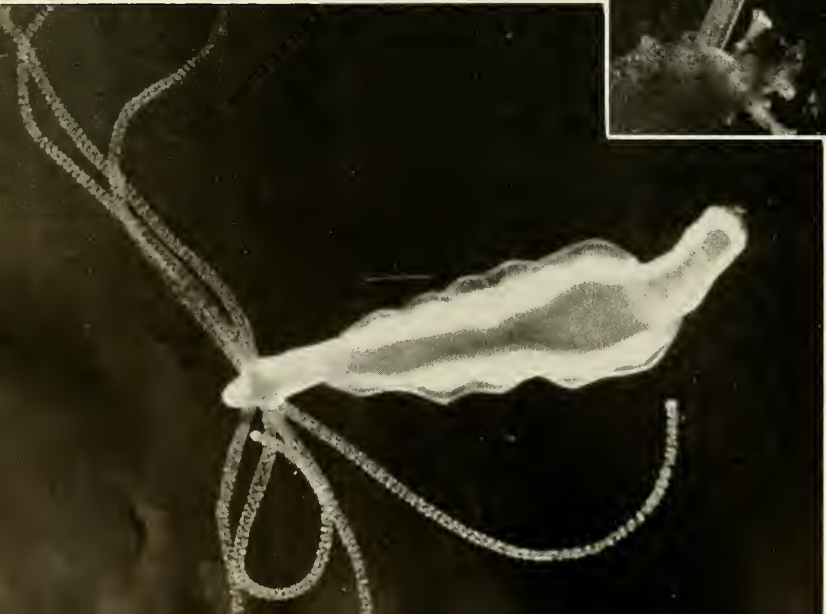
PORTRAIT O



⮝ Harmless, yet well-nigh indestructible, the Hydra might be called "The animal man cannot kill." But don't try to keep one alive in city water



⮝ An immature female. A few large round projections would identify the female Hydra as mature



⮜ The mature male has numerous small conical projections, as seen here

Hydra

The nine-headed monster of mythology had nothing on this little creature that is named after it. It has astonished scientists and amateurs alike with its fantastic performances

By N. J. Berrill
McGill University
Photographs by the author

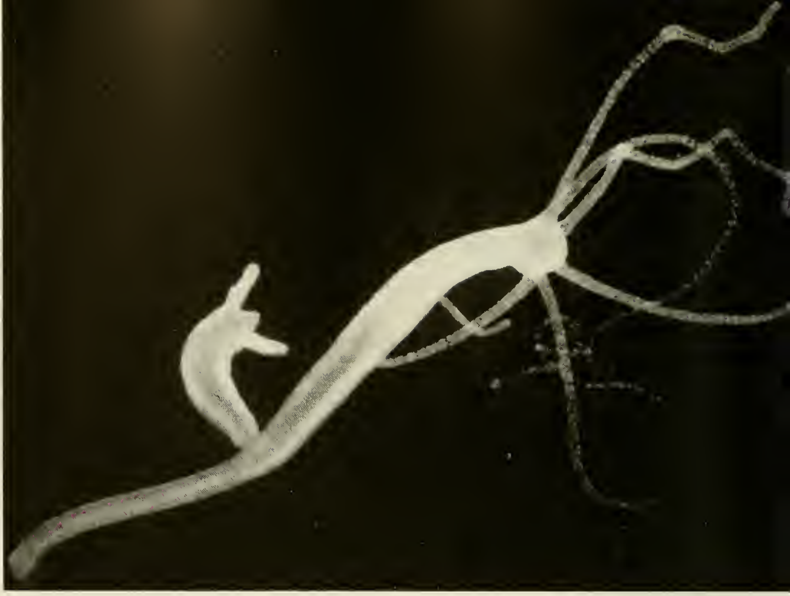
HYDRA was the name of the mythical Greek monster of Lake Lerna, fabled to have nine heads; and no sooner was one of them cut off than two sprouted out in its place. Why should it now be the name of one of the lowliest and least offensive of the minute animals of weedy ponds and slow-running waters? The story is long, for it starts in Holland in 1703, when Leeuwenhoek, peering down his simple homemade microscope, saw the creature for the first time. It can be seen well enough with the naked eye, but only if you are looking for it and know what to expect.

Forty years passed. Then the Hydra, for all its near invisibility and retiring nature, came to be more in the news than would be the sea serpent of our own day and age if it should be finally captured and shown to be some fantastic survivor from a world of long ago. A little more than 200 years ago, sometime around 1740, a poor private Swiss tutor to the children of the Comte de Bentinck in Holland, one Abraham Trembley, made an experiment in true scientific spirit to settle a little problem that had been troubling him. He had seen Hydras in the garden ponds and noticed that some of them were green. Were they plants or animals? If he could cut one in two, and both parts lived and grew into whole organisms, it must be a plant. This he did, and both parts became whole Hydras—but they were not plants, as he soon found out. For as he began to watch the little organisms more closely, he could see that they waved their fine, long tentacles through the water and caught and swallowed the small swimming animals that collided with them. So Hydra was recognized as an animal and called somewhat affectionately a little worm, for its body is thin and tubular and squirms around somewhat like a worm attached by one end. However, the ring of six or seven tentacles around the mouth at the free end reminded the famous French scientist Réaumur of an octopus, or "poulpe," so that he called it a little polyp.

Even so, all this was hardly enough to account for the excitement Hydra caused in those days. What happened was that Trembley, consumed with a typical scientific itch, could not leave well enough alone and went on to manhandle Hydra in every way he could think of. Most of his experiments anyone can do with the aid of a hand lens and a needle, and time and patience; and many people did repeat them for themselves. Otherwise the responses that Hydra was reported to make to all the mutilations were too fantastic to be believed. So here again we get an essential condition for scientific progress. No one is required to accept anybody's statement on faith or authority alone, no matter how credible or incredible the story. It has become a duty to see for yourself, to repeat the experiment and confirm the observation. More than 200 years later, Trembley's experiments are still being repeated, simply because what a Hydra can do is so amazing that each generation of biologists feels the need to convince itself that it is true.

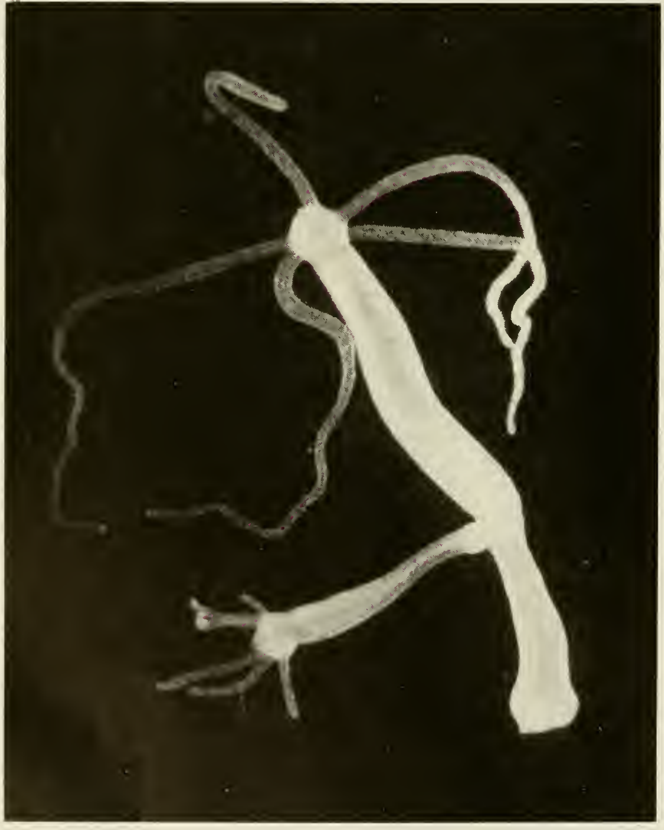
What he found was this. If the body is halved in any direction, each half in a short time grows into a perfect Hydra. If it is cut into four, or even eight pieces, each continues alive and develops into a new animal capable of being multiplied in the same extraordinary manner. If the cut is made lengthwise so as to divide the body into two slips connected merely by the tail, they are speedily fused together again into one perfect whole; or if kept apart, each becomes a Hydra, so that two or several of them are formed with but one base between them. If the ring of tentacles is cut away, it is quickly regrown, while the amputated head and tentacles equally well grow a new body. More than this, Hydras turned inside out continue to live and behave in a perfectly normal manner.

No wonder it was all difficult to believe, but when Réaumur in France, and in England the President of the Royal Society, each repeated Trembley's experiments and obtained the same results, they had to be taken as true. Réaumur reported personally to the King of France, who "appeared very pleased to hear about it," while a little later the Duke of Richmond went to Holland at the request of the Royal Society to find out more about Trembley as a man. He found him, as he wrote to the President of the Society, "one of the most agreeable men I have known . . . particularly handy and dextrous in his operations, and explains himself about them with great exactness and perspicuity." The leading men of the learned societies of England and the Continent experimented daily



➤ **Hydra with a bud.** A new individual is forming as an outgrowth from the stalk

➤ **Bud about to separate.** This is not the only way Hydras reproduce. Eggs are also dropped. They overwinter



on the little animals and transmitted them to one another from distant countries, by careful posts, as the most precious gifts. Even ambassadors interested themselves in sending early intelligence of the engrossing theme to their respective courts.

I imagine that by now, living Hydras have been closely watched more than any other animal on the earth, for the study that Trembley had for a brief time to himself has been public property for the last two centuries. It is a simple animal; but no organism, animal or plant, is too simple, and the least of them is a challenge to our understanding. If we knew all there was to know about Hydra, we would understand the essentials of life itself and comprehend what it means to be an organism.

For a many-celled animal, Hydra is almost as simple as it is possible to be. The body is little more than a hollow tube, with one end open as the mouth and the closed end attached to the weed from which it hangs. Five to eight hollow tentacles grow from a ring a little behind the mouth, and the mouth can enlarge until it resembles a cup. In fact the whole body, including the tentacles, can extend and contract to an astonishing degree. Body and tentacles together can stretch from a clumpy little object almost too small to see to a long, swaying filamentous organism two or three inches long. It hangs this way, when undisturbed, with the tentacles extending through the water like fishing lines. Fishing lines they are, for any tiny animal unlucky enough to blunder into them is stung and more or less paralyzed into immobility by batteries of nettle cells that cluster the length of the tentacles. Struggling merely brings other tentacles into action and causes them to contract and so pull the victim toward the mouth. It is then that the great extensibility of the manubrium around the mouth can be seen to advantage, for even if the prey is a water flea two or three times as fat as the Hydra, it finally gets swallowed.

What makes Hydra open its mouth to swallow, when there is no brain? Though the creature does not even have any sensory organs in the usual meaning of the word, it does have sensory cells, which is almost the same thing, since a sense organ is just a group of sensory cells. Hydra's rudimentary nervous system is concentrated around the mouth, and its response to stimuli is like that of other animals—reaction by sensory cells and conduction to a nervous center. A little meat juice will make Hydra struggle and squirm in a great effort to swallow an intangible prey.

The body of Hydra is simple in other ways. The body wall consists of just two sheets of cells, placed back to back, one of them the inner digestive layer and the other the outer epidermis. At the base of the epidermis are minute cells held in reserve and also a fine network of nerve fibers that control the movements of the animal. In a young Hydra this is about all there is, but if you put pond weed with Hydras attached into a small glass aquarium and examine them with a hand lens, you will see that most of them are busy growing new Hydras as outgrowths from their own bodies, from a region about three-quarters the way down. Below the region where the buds are forming, the Hydra becomes a narrow stalk.

Watch a particular Hydra for a few days. You will see the buds grow larger and longer, sprout their own tentacles, and one at a time break free from the parent. This they do by bending down and holding onto the weed with their tentacles. Then suddenly the base becomes disconnected from the parent's body, and over the young animals goes, in a few minutes to become attached to the weed by its own base. The tentacles let go, and it starts to fish on its own alongside its parent. This, however, is too close to be good, and so step by step the young Hydra fastens its tentacles again to the weed, draws its foot up to them, and repeats, progressing very much as if it were an inching worm. This is not quite all. If you collect Hydras in the fall, the chances are that no buds will be seen, but instead, from the region of the body from where the buds form all the way up to the neck, little projections, round or conical, break the smooth contour of the body form. If they are numerous, small, and conical, the Hydra is a sexually mature male. If few, large, and round, it is a mature female. And some Hydras can be both at once. Fertilized eggs, enclosed in a protective case, finally drop into the mud at the bottom of the pond and serve as overwintering seeds, augmenting the Hydra population in any case and perpetuating the species in the event all the grown Hydras are killed. Such is the animal as it seems to be, different at different times and under different circumstances. What actually is going on?

There is a very natural human tendency to try to understand something complex by taking it apart. The difficulty arises when one tries to put the disarticulated pieces of the watch back together. So with Hydra; the more it is taken apart, the harder it seems to put it back again. The animal has been chopped and minced in every possible way. One difficult little fact is that while most pieces of a Hydra rapidly reconstruct themselves into new perfect wholes, when the size of the piece is less than ⅛ of the original, it simply rounds up into a ball and stays that way. And if the two layers that constitute Hydra's body wall are stripped apart, no matter how much there may be of one or the other, neither can reproduce a whole organism all by itself. But put them together and they have no trouble. On the other hand, if a number of complete Hydras are minced up together so that there is nothing left but a mass of living cells looking as much like a squashy football as any kind of animal, and the mass allowed to rest on the bottom of a glass vessel of water, 3, 4, 5, or even 6 Hydras can be found growing out of it within 24 hours.

Perhaps the most controversial thing about Hydra is what really happens when it is turned inside out. Trembley and many investigators since his time managed to perform this very delicate, but to Hydra very disturbing, manipulation. A hair is inserted through the Hydra's mouth to the base and carefully withdrawn, in effect brushing the Hydra off with its digestive layer now on the outside and its skin layer inside. Quite recently a way has been found of making at least some species of Hydra do this all by themselves, of course without using a hair! If a little yeast is allowed to settle as a film on the glass to which a number of hungry Hydras are attached, each bends over and places its mouth on the yeast. Then slowly and inexorably the mouth stretches, and gradually almost the whole of the inner digestive lining is turned to the outside in an effort to plaster itself over the yeast. The result may be complete eversion, with the tentacles now sticking out of a hole lined inside now by epidermis.

What happens to an inside-out Hydra? It can die, presumably in some form of complete and devastating frustration! Or it can turn itself outside-in again in a perfectly orderly manner, by steadily drawing the rim of its mouth back down the body until the animal is the way it is designed to be. This is what normally happens, especially in the larger species of Hydra, which can stretch a little more readily than the smaller. But in those that neither die nor turn themselves back, a most peculiar recovery takes place. All the cells on the inside start moving outward between the outer cells, and the outer ones slide inward, like partners crossing over in a dance. If it happens at all, the process is in full swing within a couple of hours of the eversion, and by the end of the day the Hydra is itself again.

At long last, however, 210 years after Trembley made his first experiments, Hydras have been built that virtually tell their own story. Professor Paul Brien of Brussels has recently employed Trembley's technique in an entirely new way. He planned to do something to Hydra that had previously been done to the eggs of frogs and salamanders. This was to place a piece of agar jelly, stained red with one of the few dyes that do not kill cells, in contact with the head of a Hydra. The stain was supposed to color just the head, and then it should be possible to see something of the way a Hydra grows. It turned out, however, that Hydra is so squirmy and contractile that no accurate staining was possible. So Professor Brien took an easier course, which—believe it or not—was this: In order to get a Hydra with its head region stained red and the rest unstained, he stained one Hydra red all over and cut it in two. Another Hydra not stained at all was also cut. Then the upper red half of the first Hydra and the bottom half of the unstained Hydra were threaded like beads on a single hair and pushed together. The two pieces fused in a matter of minutes and became a single complete Hydra stained red at the top end alone. The same experiment was repeated many times, with small variations, and as a result we now know a great deal more of what it means to be a Hydra.

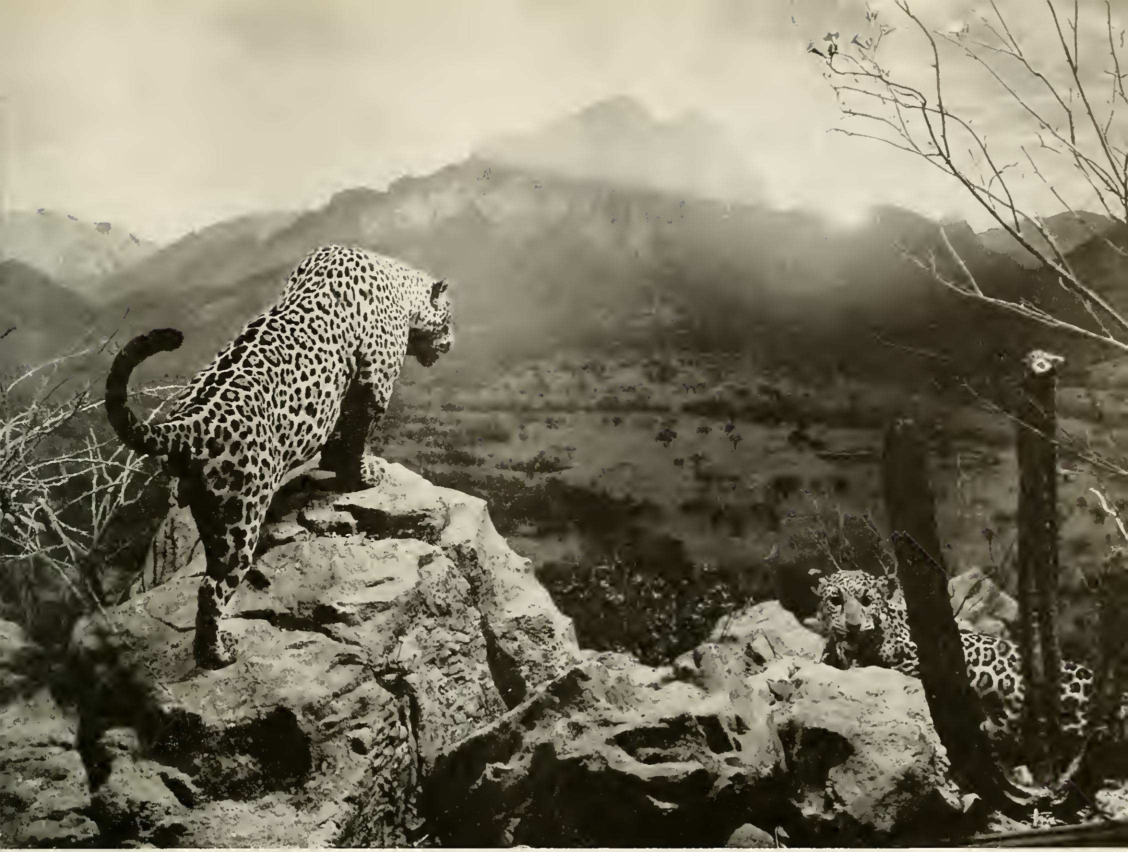
It is the particular property of this red stain that it does not diffuse from one cell to another; and if the color spreads, it means that the cells themselves are moving or multiplying. In these Hydras, the red stain slowly spread, down the body from the neck until the whole body became red. New tissue, in fact, keeps growing from a ring just below the tentacles. As more and more forms, the tissue already produced is pushed continually away, down the body. And it gets older as it passes down. When it gets about two-thirds or three-quarters of the way down, much of it takes on a new lease of activity and grows out as buds, which become new Hydras. The tissue that escapes this remains as the stalk, or pedicel, now naturally forming a tube much narrower than before, and it keeps on being pushed down toward the base. Then finally it gets really old, as Hydra tissues go, and dies.

The body of Hydra is somewhat like a candle flame, forever coming into being at one end and burning out at the other; and like the candle flame, it has a certain shape in between. In the last analysis, all organisms are like the flame—something maintained and changing between an inpouring and outpouring. In the case of Hydra this process of growth, which makes the body and gives it shape and a certain length, goes on only as long as the mouth and tentacle region remains intact. When this part finally ages and shrinks, the whole activity comes to a quick end and the Hydra is dead. But as often as not, when the head end wears out, the ring of growing tissue just below grows a new set of tentacles and front end, and the cycle of life starts anew.

Such is Hydra during most of its career—busy most of the time producing one budded offspring after another. But when it stops doing this and becomes sexually mature and produces eggs or sperm, what has happened to make Hydra so different? Brien has unraveled this as well, in the case of the brown Hydra at least, although the situation is apparently different in species other than the one he investigated. The change from nonsexual budding to sexual reproduction in brown Hydras comes only when two conditions are met. The Hydra must be in a very well-fed state, and the temperature must have dropped so far that the process of growth from the neck to the base is brought almost to a standstill. Brien demonstrated that when this happens, growth of a different kind becomes possible, which was impossible before simply because there was no time for it. For now the layer of reserve cells deep in the epidermis begins to multiply, and the epidermis becomes thicker and thicker. As it does, local patches of cells change into reproductive cells and become small conical male glands or larger ovaries, and Hydra is able to set free fertilized eggs. This commonly occurs in the fall, when well-fed Hydras first encounter winter cold. Then if the Hydras should die, the eggs are there to reseed the waters with new Hydras when spring warmth begins to return.

Hydras can be readily collected, but it is not too easy to tell when you have found them, for when weed on which they grow is taken out of the water, the animals contract so that it is almost impossible to see them. Only when the weed is put into a pan of water do the animals expand so that they become visible. Weeds taken from the shores of lakes, reservoirs, ponds, or slow-flowing rivers, though not from streams or fast rivers, are very likely to carry attached Hydras; and when placed in a glass aquarium filled with pond water, they may show quite a display. The water needs to be kept cool (below 70 degrees F.), and water from most city water supplies is fatal to them. The Hydras can be fed with live water fleas, usually obtainable where the Hydras themselves are found, and they readily reproduce in an aquarium by budding.

If you're interested in small pets, Hydras make good ones.



AMNH photo

The largest catlike animal of our continent and one of the handsomest dominates a striking scene from near the Mexican border in the American Museum's Hall of North American Mammals

HIS SPOTTED HIGHNESS, *The Jaguar*

THE Jaguar *(Panthera onca)* commonly known in Mexico as *el tigre,* appears to be related to the Old World leopard, which it closely resembles in pattern and color. The skins of the two animals are difficult to tell apart, but the presence of black dots inside the rosettes usually marks the Jaguar.

Although it is chiefly an animal of the great tropical forests, the Jaguar is also at home in the arid brush country and mountains of northern Mexico. In this region it is smaller and paler than in the forests. The Jaguar feeds upon most of the large and medium-sized animals. It is a dangerous foe when attacked, and it has no other enemies than man. Its voice is a short, hoarse roar, quite different from the scream of the Cougar.

The Jaguar climbs well in spite of its size. The largest males weigh about 300 pounds.

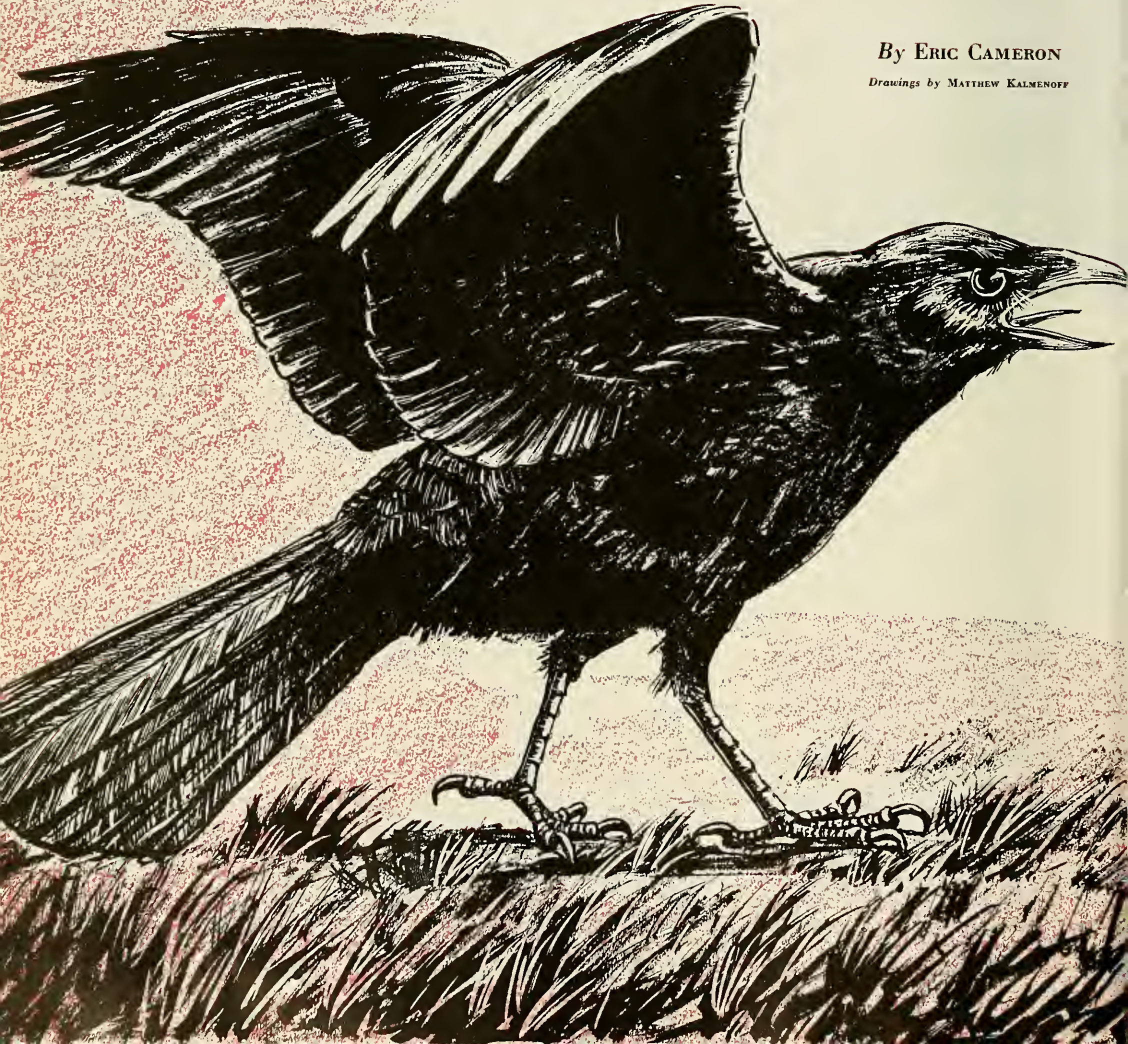
Young Jaguars are colored much like adults: their fur is longer and softer. In the north they are born in the spring, after a gestation period of about 100 days.

In the Pleistocene epoch a large Jaguar was found throughout what is now the United States.

BUTCH-
The Raucous Rascal

By Eric Cameron

Drawings by Matthew Kalmenoff



The orphaned crow was only a naked chick with a sprinkling of pinfeathers when he was adopted, but he grew up into a rowdy bundle of surprises

A CROW'S nest had been demolished by a gale, and I found the sole survivor of the disaster only because he had uttered a froglike croak when I passed near him.

Although I was stalking crows at the time, I decided to adopt the sparrow-sized orphan of the storm who squatted at my feet, his beady little eyes showing not a trace of alarm. He was naked but for a sprinkling of pinfeathers, and seemingly all head and legs.

The moment I stooped to pick him up, he croaked again, tilted back his grotesque head, then stretched open his beak to expose an extraordinarily large gullet for a creature his size. Somewhat cautiously I poked my finger into that gaping cavity. Butch, as he was later christened, immediately tried to swallow the finger and held on like a bulldog when I attempted to withdraw it.

Having safely transported him to the house by means of wrapping him gently in a handkerchief and holding the four corners, I began to wonder what a baby crow was supposed to eat. Experiment seemed the only solution.

Seeming not to miss his parents one single bit, the noisy orphan grew fat during the first month on worms, grubs, flies, and rolled oats, cereals, and chicken mash mixed with milk. As time went on and his clamor for more and more food increased, his diet came to include: mussels, clams, crabs, sea worms, fish, meat, cooked vegetables, spaghetti, beans, eggs, fruit, chocolate, cake, pie, bread, biscuits, cheese, and probably a number of things no one knew he had swallowed.

Butch earned his name when he began to display the characteristics and personality of a true "Dead End Kid" and the tactics of an embryo gangster. Actually, we did not know for sure that he was a *he*. I suppose it was not absolutely out of the question that Butch might some day lay an egg; but we certainly always thought of him as a male. Always hungry; always noisy; always demanding attention; always up to some mischief; always affectionate—was Butch the crow.

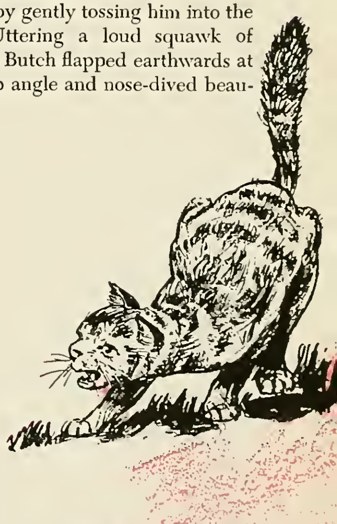
In a few weeks he was hopping about on his ridiculously long legs, which reminded one of jointed stilts. More feathers sprouted to hide his nakedness, and he devoted hours to pecking away their waxy sheaths.

Taken twice a day from his cage for exercise in the garden, Butch was closely watched because of our two half-grown cats, who were virtually wild creatures and spent much of their time in the forest. They stalked the crow about the garden, their tails twitching ominously.

But let them come within a yard of him and Butch would bound towards them, emitting piercing shrieks and flapping his still ragged wings. The cats always slunk off in disgust at such a vulgar outburst. Had they known what was in store for them they would undoubtedly have made short shrift of the crow.

Butch became an excellent flyer, though he probably took longer to solo than any of his kin. At first he amused himself by hopping—flapping awkwardly, too—from rung to rung of a ladder leaning against the woodshed, thereby gaining the roof. Up to then it had been the cats' refuge, where they could doze in the sun. On his first visit, Butch drove them to earth by rushing them with outspread wings and ferocious screeches. After that 100% successful bluff, he strutted up and down the edge of the roof, chuckling and croaking as if to say: "Now *I'm* the King of this here Castle!"

One fine day I tried to force him to fly by gently tossing him into the air. Uttering a loud squawk of alarm, Butch flapped earthwards at a steep angle and nose-dived beau-



▲ THE SIGHT OF A DOG would send Butch flapping up to the roof, but he seemed to have no fear of cats

▲ **He devoted** long patient hours to removing the bristles from paint brushes whenever he found them

tifully. However, a week of such "dual instruction" brought him to his first solo flight from the woodshed roof. It terminated as a crash landing among the sprouting potato plants.

Subsequent flights became longer and more stable. One evening, becoming rather overconfident about his aerial skill, Butch began circling over the garden to gain altitude. But his tail feathers had not yet completely developed, with the result that he maneuvered like an airplane with a damaged rudder or a drunken pilot. Then, suddenly alarmed by the height he had attained, Butch clutched desperately at an alder limb in passing and remained there, grim and silent, refusing to be coaxed down again.

Rescue by ladder being found impossible, Butch spent his first night outdoors and away from his cage. Hunger drove him down for breakfast, and from then on he never was confined in any way. I felt that whenever he wanted to leave he ought to be free to go. Nevertheless, he remained close to the house day after day, roosting in the woodshed at night.

His ragamuffin character became more pronounced every day. As a sentinel, however, he was as good as any dog during the day; he raised a terrific din if he sighted a stranger approaching. On the other hand, he could recognize us from a hundred yards or more and would swoop down to meet us, gaining himself a ride back to the house on someone's shoulder, where he amused himself by gently tweaking a convenient ear. If ignored, he might grab a beakful of hair and give it a lusty yank. Once I had the beginning of a small boil on my neck, which Butch apparently decided was something to eat, and his vigorous peck felt like the sting of a shotgun pellet.

Tame crows are said to be dyed-in-the-wool rascals and practical jokers. Butch proved no exception. But perverted as it sometimes appeared, I still like to think that he had what might be termed a sense of humor.

Whenever possible he tried to sneak undetected into the house. Then there followed a wild chase from room to room, Butch chuckling with fiendish glee at the commotion he was causing, and evading capture by scuttling under tables and beds. Once cornered, he would be given the "heave-ho" out the door, whereupon he stalked up and down the porch, screaming abuse at everyone in the house.

He devoted long, patient hours to the task of pecking or pulling labels from jars and cans on the back porch, as well as adeptly removing the bristles from paint brushes and brooms, or else carrying the kindling here, there, and everywhere.

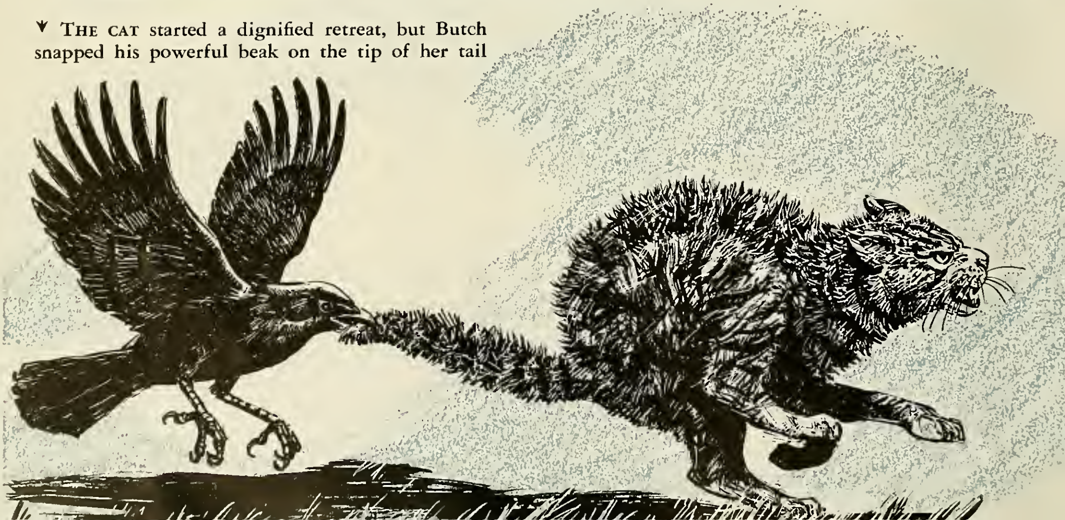
On laundry day he pecked holes in the soap or carried smaller pieces off to the roof. Our clothespins suffered the same fate. He delighted in strutting around the rim of the wash tub and could be removed only by flicking water at him, which he disliked intensely. But when the freshly washed clothes had been stretched on the line, the crow evened the score with us by leaving muddy claw tracks along the top of them or ripping thin articles to shreds.

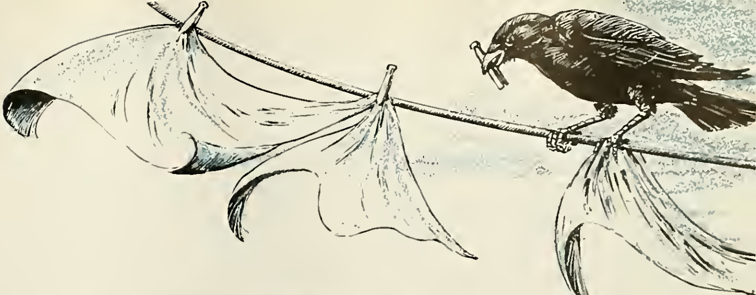
Only a few of the articles he purloined were recovered, and they included cutlery, fishing tackle, outboard motor parts, socks, handkerchiefs, combs, pencils, nails, screws, nuts, bolts, and a variety of other things not too heavy to carry in the air or drag along the ground to some hiding place.

Leave a book or magazine on the porch and it soon was in shreds. Woven cane chairs disintegrated bit by bit. The putty disappeared from around all the window panes he could reach, so that in a wind they rattled like castanets.

Promising little green tomatoes no sooner appeared on the plants than we found Butch energetically engaged in boring them full of holes, though he never did eat tomatoes. Total destruction was averted by means of chicken wire, though the entire garden couldn't be covered. The result was that he

▼ **The cat** started a dignified retreat, but Butch snapped his powerful beak on the tip of her tail





▲ HE CARRIED clothespins off to the roof

unearthed scores of immature potatoes, carrots, and beets, and perforated the sprouting cucumbers with his sharp beak.

The only punishment he seemed to understand was when someone held him down on his back, helpless and protesting like any schoolyard bully. His destructive tendencies were suffered because he did atone for them in many amusing ways.

Whenever I sat by the window at my typewriter, Butch kept me company on the sill outside, where he would rap sharply on the glass with his beak for attention or endeavor to catch insects that crawled up on the inside of the pane. Baffled by the glass, he would vainly attempt to get the insects just the same. Sometimes he literally stood on his head to do it.

The sight of a dog sent Butch flapping up to the roof. Snakes—dead or alive—threw him into a panic. Cats, although mortal enemies of birds, seemed to hold no fears whatsoever for that particular crow.

He stole mice from our cats and ate them up on the roof. Separate dishes at feeding time were useless. Butch would drive the cats away from all food until he himself was stuffed to the beak. Occasionally he made so bold as to wrest a choice tidbit from the very jaws of one of the cats. Sometimes they took an angry swipe at him, but the crow was too fast on his feet. He retaliated by pecking his adversary on the head and chasing him off the veranda.

One day a neighbor left with us his old she-cat. Because she had mothered our own two cats, we presumed that all three would get along together. But she flew at them in a spitting, snarling fury the first time she saw them.

However, Butch, sighting a strange feline, swooped down to the lawn and strutted right up to the old tabby, whose fur was bristling and her tail the size of a long toy baloon. Momentarily expecting to see the crow disappear in a swirl of feathers, I tried calling him away.

But he refused to come and suddenly stabbed his beak at the cat. Taken unawares and rather puzzled, she backed away a bit, whereupon the crow launched a vigorous attack. It was too much for the old she-cat, and she wheeled, starting a dignified retreat. Dignified, that is, until Butch went in pursuit and snapped his powerful beak on the tip of her tail. With a yowl of anguish, the cat soared into the air, then streaked for home, while Butch flew above her for a few yards, "cawing" like the rogue he was.

Butch also liked to play with people. Tug o'war with a stick or a piece of string tickled him—or let someone pick him up by the beak, swing him into the air, then let him go. He would flap around for a moment, cackling with pleasure, and come swooping down for more of the same. However, he did not like being lifted by the tail.

Some pet crows, ravens, minah birds, and others apparently learn to talk after a fashion. Butch never did. One reason is that his masters lacked the time and patience to try to teach him. He occasionally made strange gurgling noises deep in his throat, while twisting his head this way and that, much as if he might be trying to mimic words he had heard frequently spoken.

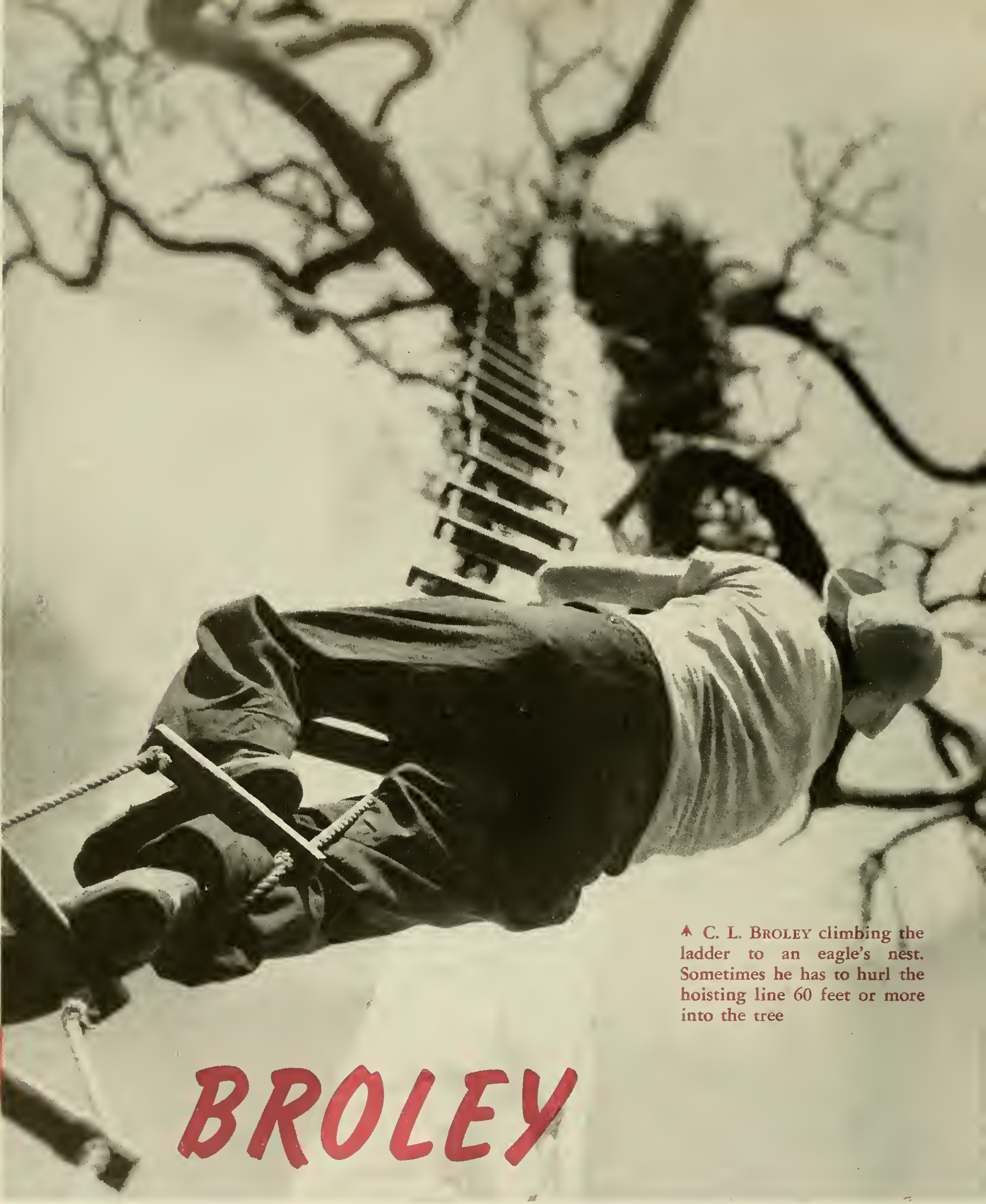
He was quite a jealous creature, unfortunately, and never could bear to watch the cats being petted. He loved to have his head scratched, too. If his loud protests went unheeded, he revenged himself upon the cats.

For a long time Butch took not a bit of notice of any wild crows that came near the house and called to him. Later on, though, he began wandering farther from the house, and he eventually joined his brethren as they searched the beach for food at low tide. One day, in fact, a friend was checking his telescopic rifle sight and drew a bead on one of several crows some distance down the beach from him. Suddenly the crow detected him. But instead of croaking the alarm and flying away, the crow flew right towards him. Of course, it was Butch again.

Toward the middle of October I had to take a trip to town. Butch came down to the wharf where we waited for the steamer. Sitting on my suitcase, he remained engrossed with the handle and fastenings until the boat arrived. The last I saw of him he was a tiny black dot perched on my friend's shoulder.

Returning a week later I was told that the day after the boat sailed Butch was nowhere to be found. It would require much stretching of the imagination to believe that a pet crow would leave because he thought I had gone for good. A more likely explanation was that he joined up with the great flock of migrating crows my friend had heard near by the day after I left. No doubt they persuaded Butch to join them.

Some crow owners claim that the birds will come back at least once. Perhaps next spring Butch will be found one fine morning pecking holes in the tomatoes once more, or suddenly flap down out of the blue to scare the hair off the two cats, who have led such a peaceful existence since he went away. His sharp tapping on the windowpane will be a welcome sound.



▲ C. L. BROLEY climbing the ladder to an eagle's nest. Sometimes he has to hurl the hoisting line 60 feet or more into the tree

Nelson Edwards photo

BROLEY bands 'em high

By MYRTLE J. BROLEY

Broley photo

▲ **THE LADDER** must be strong but light, because he carries it great distances. He uses a slingshot and nylon line on high trees

Charles Proctor photo

▲ **BOTH PARENTS.** Convenient limbs do not always give ready access to the nest as here

IT was in the first months of 1939 that Charles Lavelle Broley began banding eagles. The prospect of having a few Bald Eagles banded in Florida had been suggested by Richard Pough, now Co-ordinator of Conservation and the Use of Natural Resources at the American Museum of Natural History and then on the staff of the National Audubon Society.

Pough had been puzzled by the fact that these birds apparently moved against the seasons. They were known to raise their young in Florida in the coldest months of winter yet seemed to be absent from there in the summer. Charles Broley's banding proved that the Bald Eagles in Florida represent one of the rare cases in which a bird passes the nonbreeding season in higher and colder latitudes, or, in other words, follows a sort of "reverse migration."

When Pough sent Broley four bands, he little imagined that Broley would soon need twenty-five more and in time hundreds of them. It proved a busy season for the man who had retired the year before from the rather sedentary business of a banker and planned to take life easily. Pough had suggested that Broley get a high-school boy to climb the trees to the nests, and Broley did at first—for four birds. But the boy found himself in an undeclared war with one of the eagles, and the retired banker consequently took up the tree-climbing on his own.

To Pough's surprise, Broley had tagged 44 Bald Eagles by the end of his first season!

He had to work out his own methods, too. He soon discovered that climbing-irons were of no use

Since retiring as a banker, Charles Lavelle Broley has banded more Bald Eagles than all the other bird banders put together. The bird that symbolizes the United States is on the wane and needs protection to him. Many of the big trees had been partially burned, and the irons would not go in securely; and if he could climb up to the wide-spread nest, it was usually impossible to get into it with the irons on. He reasoned that ladders were necessary. They had to be light, for he had to carry them long distances; but they must be strong, because he was anxious not to have one break when he was 60 feet or so up in a tree. He decided his best plan was to build rope ladders with strong wooden rungs. They could be rolled up and tied. He made them 40 feet long, and where it was necessary, as when a nest was high in a tree with no low branches, he could tie two together.

To get his ladders up into the tree presented a problem for a while. At first he tossed a lead weight, attached to a long strong cord, up over the first branch. To the cord was fastened a stronger rope, which in turn pulled up a heavier one, and the ladders were tied to this and hauled into place.

Tossing the weight was, as he says, a headache. The wind would blow the line away, or it would tangle and fail to run out properly. Often it caught on the rough bark of the trees, or he might get it fairly well into place only to have it hold fast and refuse to be seesawed into the right spot. By spreading out a canvas and laying the rope back and forth along this, he got it to run out more freely. Once, however, he received a nasty shock when he stepped back and felt his foot go on something soft. He had been moving his hand holding the cord back and forth only inches from the head of a big rattler and had actually stepped on the snake!

After "throwing his arm out" one very windy day, he hit on an easier method of getting his first line up—the hardest part of the whole operation, according to this seventy-year-old bird bander, who climbs trees like a boy of twelve. He took a kitchen spoon, bent the bowl so that the weight would lie in it, and fastened the handle to a long stick. Then, with a deft flip of his lacrosse-educated wrist, he sent the line over the chosen limb.

A few years ago, Otto Pelham of Tampa gave him a fisherman's casting spool. The nylon line runs out nicely from this, and Broley has taken to using a slingshot to send the weight up and over. This, he claims, is a sure method, and he is now able to get the line over an 80-foot branch on the first attempt.

For a while he found each season's work a little easier. The eagles, unless disturbed, use the same nest year after year, so he was saved the hours of seeking them out. People knew about him and would let him know when they found a nest or saw an eagle flying with a fish. But the last few years have been hard again. Nesting trees have been cut, and building operations have sometimes alarmed a pair so much that they have moved away; so he has to try to find the new locations.

In Florida and Alaska, the two extremes of the United States, the American Bald Eagle appears to be making a last stand. Its very existence is threatened in Alaska, for there the efforts of everyone interested in wildlife have been defeated, and there is a bounty on the white head of this grand bird. In Florida, while the eagle is protected, the extensive building has taken trees and land that the eagle formerly occupied. The big birds have had to retreat to the cypress swamps or to parks, or build a lowly nest in the mangroves.

When Broley began banding, there were at least 480 nests in Florida. Now, he says, he would be hard put to find 150. For many years he had 125 nests under observation from New Port Richey

▼ **Banding discloses** migratory habits. Birds banded by Broley have been picked up as far away as James Bay. Strange as it seems, these eagles raise their young during the coldest months of winter and then fly north in summer free from family cares

Nelson Edwards photo

▲ A 12-WEEK-OLD EAGLE, the age at which the young leave the nest

to Fort Myers. Last year only 23 of these were active. A great many of the trees had been cut down or had fallen, and in some cases the land had been taken over for buildings. In the 1946 season, he banded 150 young Bald Eagles. In the spring of 1951, his total was 23 birds. How long will the eagle population last at this rate? Charles Broley urges conservation-minded people to support protective measures. Meanwhile he continues to learn what he can about the home life of his vanishing charges.

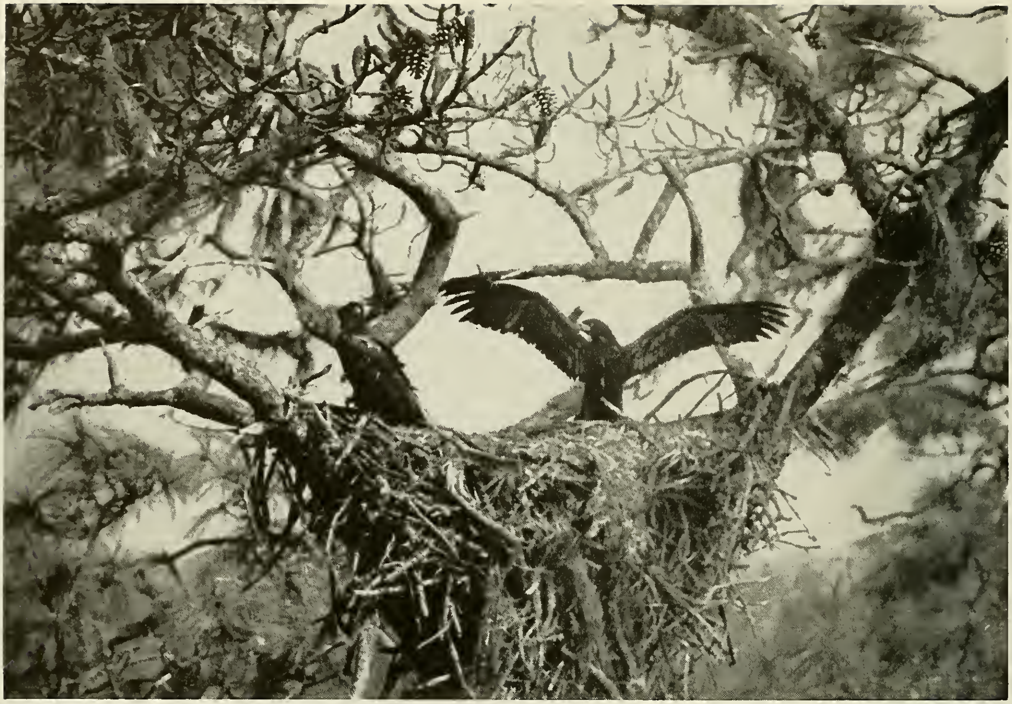
Incubation takes 35 days. The egg is smaller than one might expect, and the newly hatched young are tiny and covered with a grayish-white down. They grow rapidly, however, especially where a plentiful supply of their favorite food, fish, is available.

Until the young are about five weeks old the parents tear up the food for them. It is touching to see the tenderness with which the mother feeds small pieces to the eaglets. The male, more wary than his mate, seldom comes to the aerie when there is a blind near by, but he will drop food there, and this the female divides, giving the babies their portions. As the young grow, they become able to tear up the food for themselves. Their talons grow very rapidly, and at three weeks the large band will stay on. Broley prefers to band them at this age, for they do not tear him up as older eaglets do, nor do they try to leave when he ascends the tree.

When they are about eight weeks old, the eaglets begin to practice flying. On windy days they flap away vigorously, looking as if they wore pantalets and acting rather like a person trying to learn to swim while keeping one foot on the bottom.

The first flight of an eagle is not over the meadow but right above the nest. It rises about six or seven feet, flapping energetically and keeping its head down all the time so that it can sink into the aerie if necessary.

Often when Broley goes up to a



Charles Proctor photo

▲ **Learning to fly** at ten weeks. Charles Broley has replaced at least 60 eaglets in the nest when they could not fly back up themselves

▼ C. L. **Broley** and an 11-week-old eagle. Nests in Florida have fallen from 480 to 150 in 12 years. Our national emblem is protected in the United States, but anyone who kills the bird in Alaska is rewarded!

nest that he did not discover until the young were almost fully grown, the more timid youngster—the male—will jump off the nest and glide down, alighting possibly a couple of hundred feet away and hiding. Such a bird cannot take off from the ground again, nor will the parents feed it there, although they continue to bring food to the aerie long after the young are able to fly about. Broley never leaves these birds on the ground but searches them out and carries them back to the nest. He is sure he has put 60 or 65 of these husky youngsters back in their treetop homes.

The nests are not hollow but are slightly concave at top. They are built solidly of branches, which the eagles break off the tree, and the female uses much care in placing them. Broley says he saw one female place a branch in twelve different positions before she was satisfied. He estimates that some of the large nests contain almost a ton of material. There is a soft lining of moss and long grass. Almost all the nests in Florida contain air plants, but why the eagle carries these up, as well as numerous other things found in the nests, he cannot explain.

At twelve weeks, the young leave the nest. They are larger than their parents and are black or very dark brown in color. The white head and tail do not develop until the bird has reached maturity at about five years. The dark eye of the immature eagle changes only gradually, but the fierce yellow has arrived by the time the bird is in breeding plumage for the first time.

Until Broley began his banding, it was thought that the eagles in Florida were permanent residents. The first return of one of his banded birds was from Columbiaville, away up on the Hudson. Then other bands came in from northern states. Checking, Broley found that the young birds started north after leaving the nest. A number have been taken in the Maritime provinces, one up in James Bay and another some 300 miles north of the Canadian border between Manitoba and Minnesota. At first they all seemed to go up the coast, then one or two were taken in central states, and it was discovered that they move along with the prevailing winds. At any rate, there are no eagles in Florida in the summer months. The older birds go north also, but they hurry back in late August or early September to claim their aeries again.

A pair of eagles leave their nesting territory most reluctantly. If their tree is cut, they will rebuild in any one that is suitable. Sometimes this new nest crashes to the ground the second or third year because the tree is too small to support the huge structure. The only hope of keeping the Bald Eagle in Florida is to have more places like Everglades National Park where there are suitable trees for the nests and where the birds can raise their young in safety. A few pairs have already moved to cypress swamps, where they are fairly safe unless someone decides to cut these trees.

Another enemy of the Bald Eagle in Florida is the hurricane. Coming just at the time when the eagles are getting ready to lay, the storms excite or worry the females so much that the eggs are often resorbed, and there are no offspring for that year. Even when the eggs are laid, they often prove infertile.

Very hot, dry seasons are also bad. The embryos seem to dry up in the shell, or the eaglets, when hatched, are very weak and often succumb quickly.

Broley will not climb to an unshaded nest when the young are small if the sun is strong. The female shades the babies from the heat, and if he frightened her away, the little ones would perish.

As for Alaska, it seems a travesty indeed that so many American Bald Eagles should be shot for the bounty paid on the national emblem. The excuse is that the eagle feeds on salmon. Most of the fish on which these birds feed are dead or weakened ones which, having spawned, are unable to get back to the sea again. There are always so many of these carcasses that the fish-loving birds do not bother with other food.

Once the Bald Eagle was to be found in numbers throughout Canada and the United States. Civilization has left few places that are safe for these splendid creatures. Now is the time to make certain that those we have are saved for posterity.

Readers opposed to the bounty on Bald Eagles in Alaska can help the bird's survival by persuading their Congressmen to support legislation that will extend to Alaska the protection given this bird by Federal law in the U. S.—ED.

WHAT EVER BECAME OF JUMBO?

Continued from page 21

ican Museum of Natural History. The problem of the tusks was mentioned in several letters exchanged between Professor Ward and Barnum. They were too badly damaged to be used in either the stuffed skin or mounted skeleton. The best parts were cut into souvenirs. One slice went to the British Museum, along with a cast of Jumbo's teeth. Another was sent by Ward to Mrs. Barnum with a note suggesting that the $1200 paid for mounting Jumbo was insufficient. The hint, however, did not have the desired result. Barnum considered sending a slice of the tusk to Queen Victoria but feared her majesty would be insulted, since she opposed his bringing Jumbo to America. Barnum at first suggested that they make new tusks out of wood for the exhibits, but later in a letter to Ward he states, "Then we had better have ivory tusks exactly like the original."

Where Jumbo came from!

Jumbo was born in Africa, a bush elephant, technically *Loxodonta africana oxyotis;* there is no question about that. The popular belief is that he was captured by Arabs on the banks of the Settite River in Abyssinia in 1861 when he was about one year old and three and one-half feet high. However, the zoologist Richard Lydekker of the London Zoological Society claims that Jumbo came from the French Sudan, probably south of Lake Chad, along with another baby elephant named Sahib, who died in Paris in 1906 at the age of 46. Both animals were placed in the *Jardin des Plantes* in Paris, to which they had apparently been sold in 1862. Lydekker used Jumbo in 1907 as a type example of what he considered a new kind of elephant, which he named *Elephas africanus rothschildi.* It seems likely, therefore, that he had substantial facts to support his statement on Jumbo's birthplace. A statuette of Jumbo in the British Museum was used as the type specimen.

In 1865, after three years' sojourn in the Paris Zoo, Jumbo was moved to the Royal Zoological Gardens in

London. He was now four and one-half feet tall. Some stories have it that he was exchanged for a rhinoceros, others that he was sold. At any rate, Jumbo remained in London for eighteen years.

During his infancy, Jumbo showed no remarkable traits of character nor was he much bigger than other elephants of his age. But when he reached the age of seven, his keepers began to take note of his growing appetite. He devoured a couple of hundred pounds of hay and a barrel of potatoes a day, as well as all the apples, peanuts, and bonbons that he could wheedle out of the adults and children of London. Now he began to grow rapidly and added inch after inch to his stature. Jumbo grew bigger and bigger, and before he left London he was over eleven feet high at the shoulder and weighed more than six tons.

"Jumbo" was by no means the first elephant to reach American shores. That distinction goes to the Crowninshield Elephant, an Indian elephant from Calcutta that was landed in New York, April 13, 1796.† The first African elephant brought to America was "Old Bet." She was purchased in London, brought to New York in 1815, and sold to Hackaliah Bailey of Stephentown, later known as Somers, New York.

Jumbo was 25 years old and middle-aged when he died. Strange as it may seem, no one seems ever to have put a tape measure on this celebrated animal or weighed him. However, we can safely say that his height at the shoulder was about eleven and one-half feet, and his weight was possibly six and one-half tons. His size has been exaggerated in some reports up to eight tons in weight and twelve feet in height.

Jumbo's greatness was not only his size, but his gentle, friendly nature, with which he captivated the admiration of both young and old. He was perhaps more especially fond of children and possessed a disposition that at once created a feeling of confidence. His sympathetic response to the timid gestures of children when they presented their meager offering of friendship no matter how small, won the hearts of all. He would kneel on his forelegs, coaxing the fearful tots by this implication of assistance to climb onto his massive shoulders. These invitations would be eagerly accepted, and Jumbo would rise with his precious load. His greatest joy seemed to be in giving little children a ride on his back, and he seemed to know from their screams of pleasure that they were thoroughly enjoying it.

Though Jumbo's life was short as the lives of elephants go, his fame will outlast that of any other creature—thanks in part to the great Phineas T. Barnum, the master of American Show Business. Jumbo, in fact, has been immortalized, and his name has become a household word. It has been firmly embodied in the English language as a term signifying anything unusually large.

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† See "The Crowninshield Elephant," by George G. Goodwin, NATURAL HISTORY Magazine for Oct., 1951.

BOOKS

Continued from page 7

James P. Chapin of the American Museum of a rare pheasant, the Congo Peacock. The demand for a new and up-to-date published tribute to this wonderful group of birds has now been admirably filled by Delacour's *Pheasants of the World.* The author is uniquely qualified for this task. Long recognized as the world's leading aviculturist, he twice gathered together unsurpassed collections of living pheasants on his estates in France, only to see them destroyed by successive world wars. Many of these pheasants were obtained during a series of expeditions led in person by Captain Delacour to the remote mountains of Indo-China. Among the fruits of these explorations was a fine rare species, the Imperial Pheasant, new to science.

Most aviculturists — understandably — abhor dead birds. Delacour is the rare exception; his research papers, based on study of the large collections of pheasants preserved in the American Museum and elsewhere, are numerous and authoritative. As a result, this pheasant book contains valuable contributions to our knowledge of the systematics and distribution of these birds, as well as accounts of the history and behavior of each species in the wild and in captivity. The ranges of the various pheasants are shown on detailed maps contributed by Dr. C. A. J. Vaurie. The plates are from the brush of J. C. Harrison, whose recent book of sketches and portraits of birds evoked so much favorable comment.

Author, artist, and publisher are to be complimented on the production of an outstanding book.

D. AMADON

AQUARIUM HIGHLIGHTS

- - - - edited by William T. Innes

Innes Publishing Co.,
$5.50, 519 pp., 213 photos
(5 in color), 132 drawings

IN May, 1932, a new magazine, *The Aquarium,* appeared, which immediately became the leading American periodical devoted to the hobby of keeping fishes and other aquatic creatures as pets—a position it still maintains today. Dr. William T. Innes, its founder and editor all these years, has gathered together a selection of what seemed to be the most popular articles published in his journal during the past two decades. He has now republished them in a single handy volume.

Dr. Innes has made a good selection. The articles cover a wide variety of subjects, many of which could be of paramount importance in guiding the home aquarist. Sections of fish foods, diseases, aquatic plants, and mechanical devices such as pumps and filters are included. Not only tropical freshwater fishes are considered, but marine species and temperate freshwater forms like Goldfish as well. Many of our prominent scientific fish men are represented by articles on their specialties: C. L. Hubbs, G. S. Myers, J. T. Nichols, H. M. Smith, C. W. Coates, and Myron Gordon among others. Terraria and garden pools are not neglected.

Although of necessity a rather heterogeneous colllection of articles, notes, and letters, the book is saved for practical fact-finding and directed reading by its comprehensive index.

This book is beautifully illustrated and is a handsome publishing job all around. In the reviewer's opinion it would make an ideal holiday present for any fish hobbyist.

JAMES W. ATZ

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example of an authoritatively written popularized account of insect life in general, based specifically on the insects of Great Britain. While it is beautifully illustrated, the reader in America should keep in mind that the examples are of English insects and not American.

MONT A. CAZIER

AUDUBON'S ANIMALS. The Quadrupeds of North America

- - - - - Compiled and edited by Alice Ford

The Studio Publications, Inc. in Association with Thomas Y. Crowell Co.
$12.50, 222 pp., 156 illusts.

THIS large handsome volume brings together for the first time, in a popular price range, reproductions of all of Audubon's mammal paintings with sufficient text to explain the figures and to know the artist who created them. The first appearance of the animal prints was in an Imperial folio and a Royal octavo edition, which are today collector's items and unavailable to most readers.

The reader is given a brief sketch of Audubon's early years, his interest in nature, his training in art. He had many trials to overcome, and his career might well be cited as genius overriding every obstacle. Audubon's life history has been well publicized through recent publication of biographies and reproductions of his bird paintings; the reader of this book will find his greatest interest in Audubon as a painter of mammals. The reproductions of his paintings are of high quality.

In the opinion of this reviewer, Audubon achieved greater realism and conviction with his birds than with his mammals. As a historical figure he occupies a pre-eminent position. Many of his paintings if judged solely on the realism of modern art are vulnerable to criticism. Stripped of the Audubon halo, they would not meet the requirements of present-day illustration. The status of Audubon rests upon more than meets the eye in any particular painting.

He did a great deal of his painting from dead animals. He could not study his subjects in zoological parks, as do modern artists. His posing is often forced and unnatural. Many animals are shown with open mouths, which certainly introduces action but is dangerous if not well done. He had help on many of the figures, notably from his son, who was not as proficient as his father.

But whether one believes that Audubon reached the ultimate in pictorial expositions, or whether one thinks of him more as the catalyst that set off the development of the art that followed, Miss Ford has supplied a splendid source book and authoritative reference.

HAROLD E. ANTHONY

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Continued from page 2

tute and former Director of the Fish and Wildlife Service, explains the matter differently. In the current issue of *Audubon Magazine,* he states that "illegal hunting by market hunters and miners is known to have almost completely destroyed certain sheep herds . . . Weather and predators are credited with being factors in the reduction of these fine animals, but illegal hunting is the greatest threat of all at present." He further says that the only clearly known cause of the decline of the caribou is hunting—principally illegal.

EDWARD WEYER, JR.,
Editor
Natural History Magazine,
New York, N. Y.

What Fills the Hole?

SIRS:

After having spent hours watching the amazing spectacle of the Mexican volcano Parícutin last summer, I would greatly appreciate it if you would let me know the latest estimate of the depth from which the lava is extruded and what happens to the space from which it comes. Does it leave a hole, or does the earth settle as the top of a cake might fall in?

R. W. SHEARMAN, M.D.
Brooklyn, N. Y.

The following answer is given by Dr. Frederick H. Pough, the American Museum's Curator of Physical Geology and Mineralogy:

The lava temperatures that have been recorded at Parícutin indicate that the source of the lava must be about 55 to 60 miles beneath the earth's surface. This estimate is based upon the increase in temperature as we go below the crust. It is common knowledge that in the deep mines of the Rand district in Africa the temperatures are so high that men can work for only a few minutes at a time. However, in a region so volcanically active as the Mexican belt, it may well be that the temperature gradient climbs far more steeply; hence, the 60-mile estimate may be greater than we would give if we had more facts.

The actual bulk of Parícutin and all of its flows is slight when it is considered in relation to such depths as those we have just been talking about. Very minor settlings and readjustments, such as those that the constant earthquakes tell us are taking place, easily account for all the space once occupied by the lava and gas that has come out of the crater.

A Tree-Climbing Groundhog

SIRS:

Last June near Radnor, Pa., my wife and I found a groundhog with a liking for the higher things of life. More specifically, this groundhog was up a tree, twelve feet above ground and right beside a road carrying considerable traffic. I would like to know whether this situation is as rare as I imagine it to be.

I believe the woodchuck was asleep when I first saw him. His muzzle was resting on a twig, and his eyes were closed. As we took a closer look, he regarded us with little evidence of agitation.

When I returned with a simple camera, the situation had not changed, and my activity in taking twelve exposures left him unruffled. Returning again with a relative, I shook the tree. Half an hour later we passed the spot, and he had uncurled and was standing on two limbs.

I have no real explanation of why this woodchuck was a climber, except that it was a cool spot on a hot day, and he could watch the cars go by—if he wanted.

L. B. HAYES.
Philadelphia, Pa.

The following information is offered by Mr. T. Donald Carter of the American Museum's Department of Mammals:

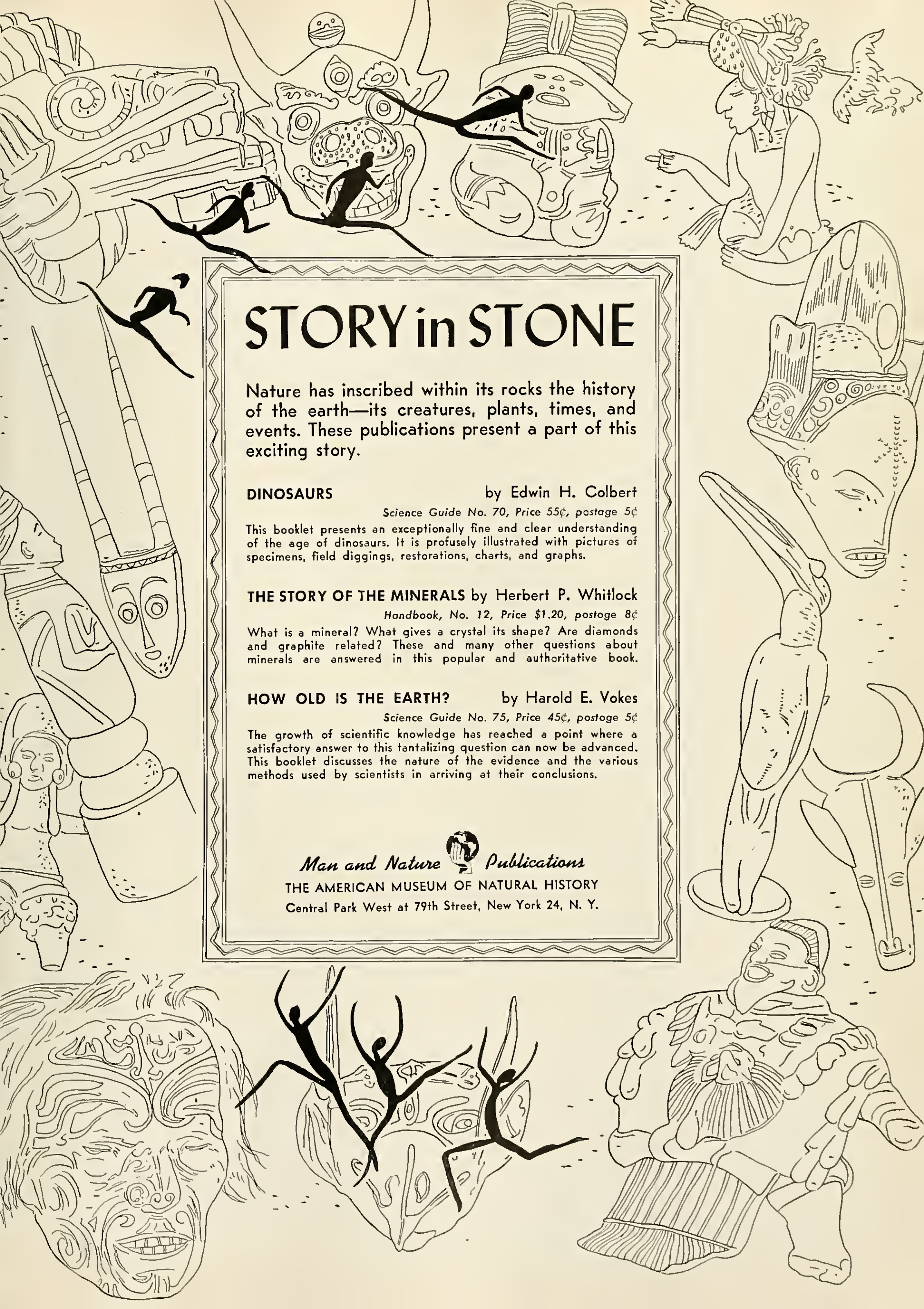
Woodchucks are more accomplished climbers than is generally believed. They often sun themselves on top of a rail fence or woodpile and have occasionally been observed in the branches of a tree. As a rule the tree chosen is not large in diameter or too difficult to climb, but rarely a woodchuck has been observed well up in the branches of a large tree. The animal may have climbed to escape an enemy—a dog could have surprised it at some distance from its burrow—, but sometimes the animal climbs for no other reason than to rest and sun itself well out of harm's way.

Walrus Mystery

Two hundred dead walrus are reported to have been washed ashore near the Eskimo village of Kukulik on St. Lawrence Island, according to word received at the American Museum from Otto William Geist, Research Associate in Paleontology at the University of Alaska. It is by no means normal for so many walrus to die of natural causes. The animal is of vital importance in the economy of some Eskimo groups and is not numerous enough to withstand needless slaughter. This report has therefore caused concern among biologists and conservationists.

Among other theories, it has been conjectured that the walrus might have been killed by a strong undersea explosion, but no investigation has been made of the bodies to learn the cause of death.

The animals are described as possibly having been dead at least a year. The Eskimos have been removing the ivory tusks to use them in their crafts. NATURAL HISTORY Magazine is endeavoring to initiate the sort of inquiry that would lead to an explanation of the mystery.



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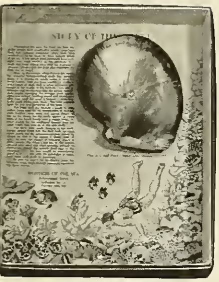

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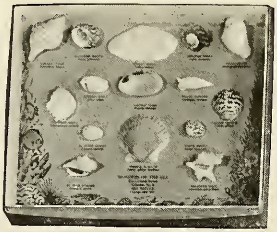

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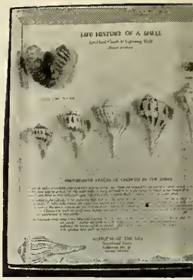

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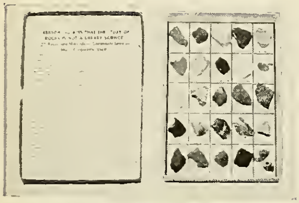

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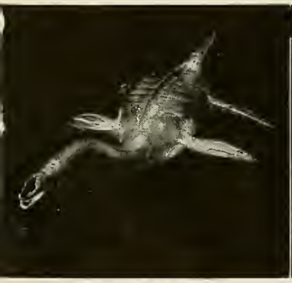

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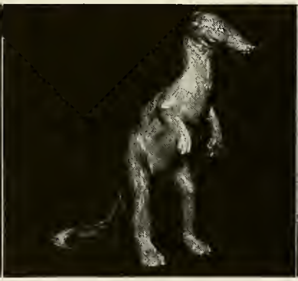

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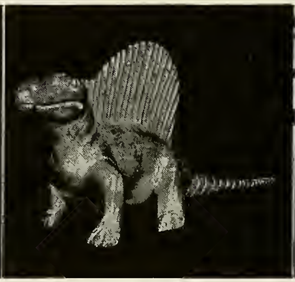

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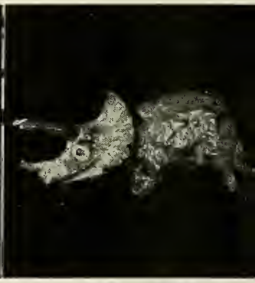

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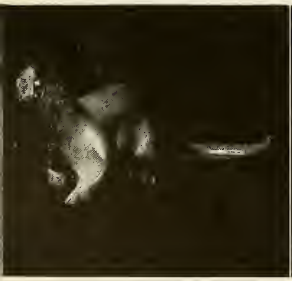

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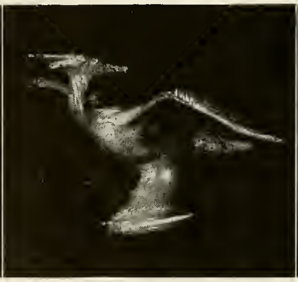

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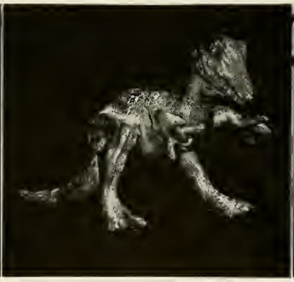

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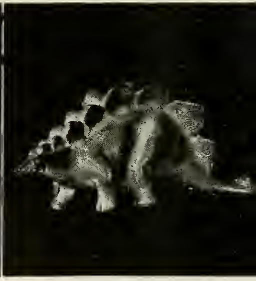

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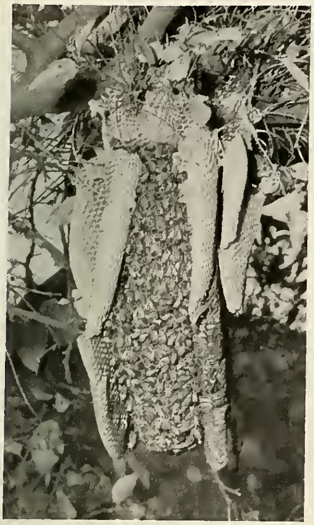

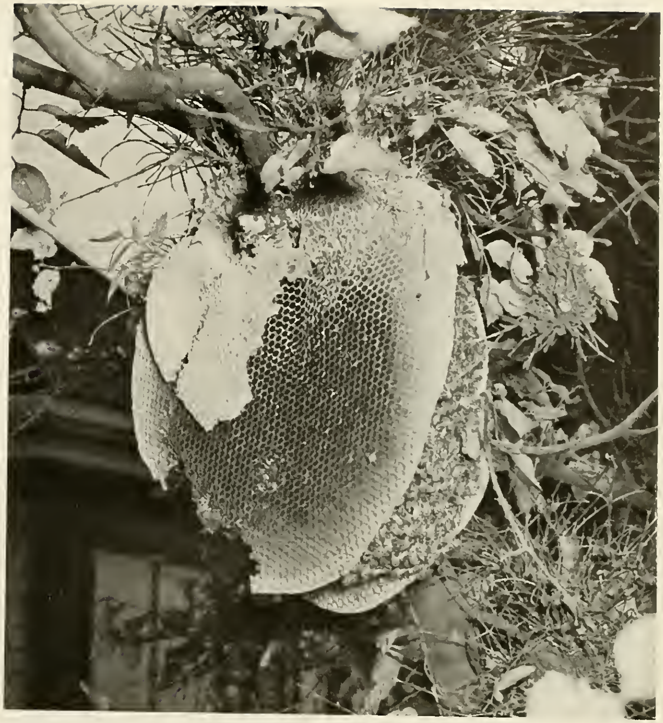

Open-air Housing

SIRS:

The accompanying photographs show the nest of some honeybees built under what seem to us extraordinary circumstances. Instead of going into a hollow in an otherwise sound tree as they customarily do, these bees built their nest in the open air approximately 12 feet off the ground in a bush in front of Kendall House, Harvard Law School, in Cambridge, Massachusetts. The nest consists in the main of two pear-shaped pieces of comb some 18 inches long and 12 inches wide, separated by 2 or 3 inches. The bees are clustered in the space between them.

It was during the first week of October, 1951, that the nest was first called to the attention of my father, Dr. George Harold Edgell, whose hobby is hunting wild bees, and who is the author of a monograph on the subject. He thought on first hearing of the nest that the insects must surely be wasps, but examination showed immediately that they were honeybees.

It was a cool, overcast day when I photographed the nest, and the bees were torpid. Perhaps a dozen of them flew right past my head toward the nest as I stood on a high stepladder taking the pictures. A cold wind and rainstorm on November first killed them.

The only theory we can advance is that the bees settled in the bush while swarming—a common occurrence—and that a few of them became confused and started to make comb out of the honey they had carried with them from the mother hive. The whole swarm must then have joined in, establishing themselves a precarious home.

HENRY W. EDGELL
Cambridge, Mass.

The following comments are offered by Herbert F. Schwarz of the American Museum's Department of Insects and Spiders:

As Mr. Edgell indicates, it is usual for the honeybee to seek a hollow for the establishment of its nest, and indeed in areas where wintry conditions prevail a failure to do so almost inevitably dooms the colony to extinction. Yet now and then open-air colonies are noted. E. F. Philips in his *Beekeeping* reproduces such an exposed nest, which survived until nearly mid-winter, only to succumb during a blizzard. E. W. Teale also offers a photograph of an open-air nest in *The Golden Throng*. A nest of this type was made available by the American Museum as an illustration in W. M. Wheeler's *Social Life among the Insects*, and other published instances of this aberrant building method of our bees might be cited. Nevertheless, the phenomenon is sufficiently unusual to occasion surprise, not infrequently even on the part of those conversant with the ways of bees.

Special circumstances probably dictate such departures from the standard building behavior. The clustered bees, gathered on some branch at swarming time, may have been delayed in their activities by adverse weather conditions and thus induced to build on the spot instead of seeking more suitable quarters. Perhaps a proper shelter was not available in the area explored; or other unsuspected causes may have played a part.

In demonstrating this unorthodox choice of a nest site, these apostate colonies of our honeybee *Apis mellifera* are, however, conforming with what is standard practice for the dwarf honeybee, *Apis florea*, and the giant honeybee, *Apis dorsata*, of the Indo-Malayan region. It is the exposed combs of *Apis dorsata* that particularly attract attention. The tree preponderantly favored for the establishment of the pendent open-air nests of this bee is the towering *Koomparsia parviflora*, whose branches, a hundred feet or more above the forest floor, sometimes bear combs in astonishing number. On a tree in Sumatra, G. Schneider counted no less than 65 combs. Comparison with a laden Christmas tree might seem pertinent but must be rejected, for the ornamentation in this case is confined to the crown of the tree and, in contrast to the light trinkets and bulbs with which we deck our trees at holiday time, it is of almost Gargantuan ponderosity. Single combs may be a meter or more in extent, and 70,000 cells have been reported by Heinrich Friese as occupying a square meter of surface.

Yet the natives are not deterred from making the adventurous climb required to gather such coveted depositories of honey. Alfred R. Wallace recorded that in Borneo the Dyaks would scale the tree at night, "building up their Bamboo ladder as they go." In a honey-pillaging undertaking in Sumatra that G. Schneider witnessed, the ascent was made in the afternoon. The honey-gatherer at a dizzy height crawled along a limb that was laden with combs, used a smoky torch provided by his assistants on the ground to disperse the bees from a given comb, and then gathered in his treasure by cutting the vacated comb free of the limb and placing it in a basket he had carried aloft for that purpose.

When one contemplates the hazards that attend such an adventure, one may well rejoice that our honeybee, in addition to its other virtues, builds accessibly, even to the extent of adopting the artificial enclosures that man provides for it in expanding his apiaries. It is our good fortune that such possibly atavistic impulses as constructing exposed nests on the branches of trees rarely find expression in our tractable honey provider.

The Squirrel's Meow

Sirs:

I live in a wooded section of Westchester County, N. Y., where there are many gray squirrels, some of which have become quite tame. Occasionally while I am feeding the tamest one, he will dash away up into a tree and utter a sound that is like a cat's meow, followed by chattering. In each instance, I have found upon investigation that a cat has approached the neighborhood. Is it possible that the squirrel's cat call is knowingly the sound a cat makes and is uttered to warn other squirrels in the vicinity? The sound may be described as—"Meouw, st-st-st- meouw, st-st-st" repeated indefinitely.

Frank E. Fite.

Harmon, N. Y.

The following information is offered by T. Donald Carter of the American Museum's Department of Mammals:

The type of scolding that Mr. Fite describes is not as frequently heard as the typical notes of the gray squirrel, but it is not uncommon. I am sure that the presence of the cat may have been the cause of the scolding, but I am also sure it had no effect on the type of scolding. Some squirrels may express themselves in this way oftener.

In his *Lives of Game Animals,* Ernest Thompson Seton quotes Dr. Lillian D. Powers as follows: "At first, it was a sharp, insistent, rhythmical cry like the mewing of a cat, then it rolled forth in a string of 'qua, qua, qua's,' then quickened into a harsh rattling like the roll of musketry." This, however, was supposed to be a love song of a gray squirrel.

In some parts of the country, the gray squirrel is known as the cat squirrel. My understanding has been that this name is used to differentiate it from the larger fox squirrel, but there is a possibility that its notes may have something to do with the name.

Gunners and Parks

Do You Want Hunting in National Parks?

Sirs:

How could you!

Here you spoil a perfectly good article by a widely esteemed naturalist, as Mr. Murie certainly is, by a horrible, misleading propaganda picture of the lowest sort. Do you believe your readers merit that?

Probably you'd like to explain—and probably you should do it in print—where we're proposing to shoot full-antlered elk in the outdoor summer picnic season?

This is from a long-time reader, a duck hunter, not a deer hunter, with a continuing interest in the outdoors.

Ferd Luthy.

Peoria, Ill.

The National Parks stay open as long as the season and the attendance permit—many of them the year round. There should be elk in parks far enough south for picnicking in the fall when elk are full antlered, but gunners killed them long ago. That picture asks the question, "Do you want hunting in National Parks?" Frankly, we don't know where the hunters will propose to shoot next. All we know is that when hunting becomes a seasonal question in the National Parks, a lot of people who don't carry guns when they're enjoying nature won't like it.—Ed.

Sirs:

I am deeply interested in the article in the December Natural History: "Do You Want Hunting in National Parks?" I remember hearing about the movement at the time but did not know it had passed Congress. Those well-meaning legislators who prepared the bill were naive if they thought that their own wishes on the subject could keep the bill from establishing a precedent.

I foresee endless controversy over anything so ardently desired by hunters as shooting in the National Parks, where the animals often lose fear of man and are easy to shoot. I know, of course, that the animals have to be thinned out or starve. But it should not be done by allowing hunting. Anyone who knows the long fights over bag limits and other restrictions . . . will realize what a bad thing this is going to prove for the National Parks. . . . I have attended hearings . . . and I know how strong the opposition to conservation of the Parks can be.

Thank you for publishing the article. . . .

I think the December issue is very fine. Congratulations.

Mrs. C. C. Marshall,
President.

National Life Conservation Society
New York, N. Y.

Sirs:

. . . Kindly renew my subscription to our valued and, to me, at times highly controversial publication.

Anyhow, there can be nary whit of controversy over the most excellent and informative reproductions of your black-and-white photographs and Kodachromes. My particular felicitations to your Editorial and Art and Production staffs on the excellence of the articles and illustrations in the October number.

Frank H. Waskey.

Dillingham, Alaska.

Sirs:

As an old member of some fifteen years, standing, I feel that I should tell you how greatly I have enjoyed reading Natural History. It is truly a splendid publication for all people.

Frederick W. York.

Providence, R. I.

Sirs:

This magazine, Natural History, is a prize delight in my home.

Mrs. Clara G. Howell.

East Orange, N. J.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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FEBRUARY, 1952

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You will find Natural History Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The photograph on the cover shows one of the commonest and handsomest of the aloes, *Aloe ferox* Miller. The aloes belong to the Lily Family and are very characteristic of southern Africa. This specimen was photographed in the arid eastern Cape Province near Oudtshoorn.

In general habit, the aloes resemble their close relatives, the familiar yuccas and agaves (century plants) of our own Southwestern deserts. Unlike them, the aloes have a yellow sap in their succulent leaves from which is derived the crude drug, bitter aloes. The leaves of *Aloe ferox* are the chief source of this drug in the Cape Province.

Besides being of commercial importance, *Aloe ferox* is one of the most widespread of the 132 species recorded from the Union of South Africa. Being so well known, this plant has even been suggested as a fitting candidate for that country's national floral emblem. And well might it serve in that capacity, for during the South African winter (June to September) it comes into its own, and its candelabra-like blossoms brighten the rocky hills and more arid parts of the veld as though with a million candles.

W. H. Hodge

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ANIMAL WONDER WORLD

- - - - - - - - - - by Frank W. Lane

Sheridan House, $4.00
310 pp., 75 illusts.

MR. LANE has long been a popular writer on natural history subjects. In the present volume both text and illustrations put before us an extraordinary, and often exciting, array of facts. They exemplify the anecdotal method of reporting on such matters as the split second in nature, the danger to aircraft from flying birds, strange uses for animals, whether or not animals have a time sense, the unexplained habit of "anting" among birds, bird hitchhikers on other birds, and numerous equally surprising matters.

In this book, however, the "anecdote" is satisfactorily cleared of its usual derogatory connotation in scientific usage, because the author is very careful to present both sides of each argument. He makes no special plea for phenomena that border on the incredible, and even the most critical reader will find it hard not to believe that the greater number of the reported incidents have happened, regardless of whether or not they are normal or frequent examples of animal behavior. Nearly every statement made is well documented. In fact, the bibliography of some 500 titles, filling pages 277 to 300, is an important and permanently useful feature of this book. The list of references is classified by chapters, of which there are thirteen in the volume. The sources of the author's data or discussions have been published in several languages, and represent an extremely wide range from folklore and well-attested popular accounts to scientific research of the most serious and reputable kind.

The extraordinary hazards to which man has subjected himself since he became a flying creature, invading the aerial zone of birds, are detailed in one of the most interesting sections of the book. Most readers will be surprised at the amount of experimentation that has been undertaken with the object of avoiding or minimizing these hazards. The last two chapters deal with the dramatic story of the extinction of the passenger pigeon and the near-extinction but ultimate saving of the American buffalo. It is gratifying to see that the oft-mentioned "mystery" of the pigeon's passing gets no credence here. Mr. Lane makes it abundantly clear that there is nothing mysterious about it. Our continent is bereft of one of its outstanding primitive wonders merely because of the greedy and brutal destructiveness of its invading European settlers and their descendants.

R. C. MURPHY

HORSES

- - - - by George Gaylord Simpson

Oxford University Press, $6.50
247 pp., 32 pls, 34 text figs.

THIS is an adequate and admirably written discussion of the evolution of horses based upon the amazingly rich collection in the American Museum of Natural History by a man whose knowledge and understanding amply fit him for the production of an authoritative and lucidly written book.

This comprehensive volume discusses the living horses, their anatomical characteristics, their distinctive features, origin, and history, including the various breeds that man has produced.

Horses form one of the most perfect series of evidences of evolution—changes in skull and brain, in the teeth, and the limbs and feet, all of which are available in the fossil record. The pattern of evolution may readily be deduced from this factual evidence, but the interpretation of the evolutionary factors and why they have originated is another matter. These factors are adequately discussed and evaluated. Speed is the principal element in the survival of an otherwise defenseless animal. The dentition shows very clearly the adaptation of horses to the nature of their food.

But back of these factors lies the query "Why?" Of this Simpson says: "It is a peculiarity of any answer to the question 'Why?' that another 'why' lies beyond it. We reply to conditional or intermediate 'whys,' and never come to the ultimate explanation. Genes, selection, and the multitude of associated factors explain why evolution occurs, but why do these factors operate as they do? Why, in fact, do they exist? Whence came these materials and whence the natural laws under which they live and are molded? Here is the last 'why,' and here the domain of science has been left behind.

A list of museums where fossil horses

may be seen is given, together with a selected group of evaluated references for those who wish to read further.

The volume is a fine example of book-making and by virtue of its typography, illustrations, and contents a very satisfying book to own.

Richard Swann Lull

MEXICAN BIRDS: FIRST IMPRESSIONS

- - - - - by George Miksch Sutton

University of Okla. Press, $10.00
282 pp., 16 colored plates,
63 black-and-white drawings

IN recent years, more and more bird lovers, naturalists, and biologists have betaken themselves "South of the border, down Mexico way." What more convenient way to see a great variety of new, colorful birds and plants in a setting that even the most blasé Northerner must find picturesque and exotic?

No one is better qualified to introduce the birds of Old Mexico to this large and increasing group of enthusiasts than George Miksch Sutton, the artist-naturalist who for the past decade or more has devoted much of his time to studying and painting the birds of that country. Dr. Sutton's technical papers on Mexican birds are known to specialists. His collection of beautifully prepared specimens has been admired by a smaller group, but in the present volume his delicate water colors of Mexican birds, painted in the field, are for the first time available to the general public.

These paintings compare favorably (and no higher praise could be bestowed upon them) with those comprising the celebrated Abyssinian portfolio of the great nature artist, Louis Agassiz Fuertes.

The text of *Mexican Birds* is a day-by-day account of the birds observed by Sutton and two companions on a first trip to Mexico. Although well written, the narrative has a certain sameness throughout, and an occasional digression, whether in a light or a serious vein, would have been welcome. Not the least important feature of this book is an appendix containing a brief summary, family by family, of the appearance and distribution of all species of birds native to Mexico, many of which are illustrated either by paintings or by pen-and-ink drawings. In lieu of a guide to the birds of Mexico—of which many are promised but none is as yet available—Sutton's *Mexican Birds*, quite apart from the appeal of its lovely illustrations, will be of real service to those seeking to familiarize themselves with the birds of that country.

Dean Amadon

Yes,

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STALKING BIRDS WITH A COLOR CAMERA

- - - - - - - - - by Arthur A. Allen

National Geographic Society, $7.50
328 pp., 331 color illusts.,
86 black and white

FOR sheer money's worth there is no bargain in bird books like this. Superlatives are apt to boomerang, but the reviewer is ready to call the volume the most remarkable collection of color photographs of birds ever brought between two covers. There are 331 of them, of which five out of six are by the author! The North American species portrayed number 266, or more than a third of those native to the continent north of Mexico. Black-and-white photographs of equal excellence picture many additional forms.

There is no gainsaying that Professor Allen, of Cornell, has stood for several decades in the forefront of spellbinding bird photography. His triumphs—far too numerous to list—run from the filming of a drumming grouse (with synchronized sound, too) to the amazing stroboscopic snapshots that freeze a five-thousandth part of a single second of life and reveal each moving part—feather, or tongue, or third eyelid—in flawless detail. Supplemented by equally miraculous examples of the work of Edgerton and other leaders and veterans, and edited by Dr. Gilbert Grosvenor, who is uniquely equipped to judge and select the cream of the crop, we have a product without a peer.

The chapters discuss bird stalking, photographing by means of the electric flash, birds as allies of man, the calendar of a bird's year, the travels of birds, duck hunting (but not with a gun), the sense organs and minds of birds, the search for the rare and unknown in various parts of North America, and the amazing stroboscopic studies of hummingbird flight by Edgerton, Niedrach, and Van Riper.

All of this tells hard and exciting facts in easy language. The only error noted relates to the basis of a sense of smell in birds. Allen writes: "The olfactory lobe of the brain is very small in buzzards [vultures], *as in all other birds*" (italics mine). In the New Zealand kiwi the olfactory lobes are very large. In albatrosses and petrels they are relatively large and are almost certainly functional as organs of smell.

R. C. M.

GODS, GRAVES, AND SCHOLARS:

- - - - - - - - - - by C. W. Ceram

Alfred A. Knopf, $5.75
414 pp., 32 illusts.

THIS is an account of some of the high points in the history of archaeology, —of Schliemann's momentous excavations at Troy, of Champollion's success in finding the key to the Egyptian hieroglyphs, of the finding by Carter and Carnarvon of the fabulously rich tomb of Tutankhamen, and of many other notable men and events that have marked the path of our slowly growing knowledge of past civilizations. With an emphasis on the lives of the men involved and with a certain dramatization of the events leading up to the great "finds," it makes a rather exciting story of a kind guaranteed to appeal to a large number of readers. At the same time, it provides a general survey of what is known of the past history of our civilization as it has been revealed by archaeological research.

The longest of the four sections of the book deals with Egypt and seems to me to be particularly good. Another section on Classical and Cretan archaeology is also good reading, but that on Mesopotamia strikes me as being rather dull and muddled. The fourth section covers Mexico and Central America and includes an account of Stephens' discovery of Copan and of E. H. Thompson's explorations in the Sacred Cenote at Chichen Itzá.

Continued on page 96

Whatever
custom or costume or color

SOME years ago, the chance came to me to join an Arctic expedition. Several months later, after many weeks in a sailing vessel, I found myself walking along the Arctic coast of Alaska. I was separated from my companions and was traveling toward an Eskimo village at Cape Prince of Wales.

It was dawn. The mountains ahead and the ice-dotted sea behind would have stirred an artist, but I was in no spirit to find beauty in this unfriendly land. The Arctic had given me a rough time—days of hunger and a near-sinking in a skin boat only a few hours before. Like Sam McGee in the poem, I was saying, "Why I left my home in the South to roam round the Pole, God only knows."

In the distance I saw a man walking toward me. His red-brown face and the mass of black hair that circled it above the parka hood lying on his shoulders made him look like a figure out of the Stone Age.

I was uneasy about how this "cave man" would treat me. Alaskans had told me how poorly the Eskimos rated the white man. I doubtless looked foolish to him in my un-Eskimo sheepskin coat and woolen cap. He would think me an awkward person who would make mistakes in the simplest tasks. He might expect me to mistreat anyone of whom I could get the advantage.

Perhaps the man in furs would only stare and pass by. Perhaps he would make fun of my clothes. He might examine my white skin with thinly hidden amusement. Surely he would want to know what I thought I was doing in his hunting grounds.

He did none of these things. His first words reminded me that an Eskimo is always kind to a stranger in want.

"Do you need meat?" he asked.

I hadn't eaten for hours, but I said, "No."

What he said next has given me food for thought through the years.

"How are your people?" he asked.

* * *

The fellow-feeling those words stirred in me has left me marveling at the personal charm of that man of nature. His simple question threw a bridge across the ages of history that separated us. With all our civilized know-how, we could learn from him about the miracle of friendship. I thought of the ill will that grows up between closer neighbors.

I think now of that friendly fellow in his animal skins because Brotherhood Week is coming, February 17 to 24. We shall have to make an honest effort to love our neighbor regardless of his custom or costume or color.

In the American way, we shall try to settle everything in a week. To those who do not know us, it may look as if we are wheeling out the old bus to see if it will run after having its radiator drained for 51 weeks to avoid freezing. But it is our nature to be friendly, to give freely.

To our open-handedness, let us add the open heart of true Brotherhood—for the full 52 weeks. Let us bridge the ill will that divides people of different birth or belief. Let us say—from our hearts—"How are your people?" Even as a little child lets its anger or fear be brushed quickly away, even as in the helplessness of sleep we forget the evil and know that the good is right, let us give ourselves over to the ideal of Brotherhood.

* * *

There are probably a hundred ways of doing it wrong for every right one. I don't doubt that we have made our share of mistakes in NATURAL HISTORY. We often try to acquaint you with people quite different from ourselves. We want to do so fairly, humbly, and with good will.

We cannot calmly watch the destruction of native cultures. We are not satisfied with the things that would make an Eskimo or an Indian a second-class white man. We cannot gloss over the ugly words that rob a people of their self-respect or the dignity of their traditions.

Great progress has been made in our time toward the ideal of Brotherhood. Only the worst mistakes were called wrong a generation ago. Brotherhood has no real enemy except the falsehood that something else will work instead. No evil can darken the light that Brotherhood kindles in our hearts. Its ways are mysterious. No matter how deep the hurt, Brotherhood can repair it when the heart is humble and honest.

Some of the articles in NATURAL HISTORY show how great is the injury that civilized man can do to the native. I hope that you read them, as we do, with the solemn hope that before 52 weeks roll round again, the native peoples all over the world, and our own underprivileged still yearning to breathe free, will have better reason to call us Brother than we have yet given them.

EDWARD WEYER, JR.,
Editor

P. W. Holzgraf photo

Is There Time TO SAVE THE ESKIMO?

White man's exploitation of the Arctic is reducing the once independent Eskimo from sturdy individualism to pauperism

By PHILIP H. GODSELL*

WRITING on the necessity for conserving the game resources of the Arctic as far back as November, 1931, from the experience of 25 years in the North, I issued a warning: "The Fur Trade, its own worst enemy, has made countless past mistakes. The time has come, however, when such errors cannot be repeated without serious consequences to the natives . . . and only intelligent intervention by the Government can safeguard and protect both natives and natural resources from undue exploitation. . . ." I went on to say that if closer restrictions were not enforced on hunting and trapping, and on the sale of unlimited supplies of ammunition to irresponsible natives, Canada was likely soon to be confronted with a difficult and expensive Eskimo and Indian problem.

That I was correct in my forecast is now more than demonstrated by the following report from Commissioner Stuart T. Wood of the Royal Canadian Mounted Police, an old Arctic friend of mine: "Canada's 7000 Eskimos in the Northwest Territories and the Yukon don't live so much by their wits nowadays—not since the shortage of game, the decline in fur prices, and the advent of Government relief for destitution."

If sea mammals, caribou, and fur-bearing animals don't increase, the 1950 Annual Report of the Royal Canadian Mounted Police continues, the Eskimos will come to rely more and more on relief from the white man. Already many of these same relief measures have been necessary to save Eskimos from death by starvation and to ward off epidemics aggravated by malnutrition. The report adds that, among the formerly law-abiding Eskimos and Indians, crime appears to be on the increase. This is no doubt largely due to these causes and to the fact that, while the authorities have taken vigorous steps to suppress the abuse of liquor among these people, they have little control over economic conditions, which have rapidly deteriorated.

"The necessity for relief of destitution amongst Eskimos has been increasing in the past few years," adds the Commissioner, who has long been familiar, from personal experience, with Arctic conditions, "and there are complaints from various detachments that the formerly self-sustaining Eskimos are relying more and more on relief . . . rather than depending on their own initiative and the natural resources of the country, as they did in years gone by." In justice to the Eskimos, he reminds us that they were once sturdy individualists, taking a pride in their ability to support themselves in comfort from the resources of the Arctic. Now they are victims of a serious shortage of game. The herds of caribou, which not so long ago darkened the face of the tundra and the rocky uplands of Ungava during their mighty migrations, have now been all but eliminated in many regions.

In summarizing, the report shows how the once self-sustaining people of the polar spaces have been brought to the point where they are forced to depend more and more on a handout from the very people who, by their thoughtlessness and avarice, have destroyed the game and other resources upon which the native population depended solely for its existence. "*They know*," the report concludes, "*they can expect relief when in need, and they have now come to depend on it.*"

Yet, when Vilhjalmur Stefansson, following in the wake of the ubiquitous Sea Wolf, Captain Klengenberg, discovered the so-called "Blond" Eskimos on the ice of Dolphin and Union Straits only four

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* The author has been Inspecting Officer for the Hudson's Bay Company for the Saskatchewan, Athabasca, Peace River, Mackenzie River, and Western Arctic districts, and Director of Folklore and Local History Project for the University of Alberta under Rockefeller Foundation grant. He is the author of *Arctic Trader, Red Hunters of the Snows, The Romance of the Alaska Highway*, etc. ED.

National Museum of Canada, Ottawa

THE ESKIMOS enjoyed good health on a sound diet when they lived close to nature in dwellings like the one shown at left. Civilized traffic created trading centers like the one below on Herschel Island, which radically undermined Eskimo economy

Philip H. Godsell photo

decades ago, these primitive natives of the Coronation Gulf region were, from their point of view, living in the lap of luxury. They had lots of caribou meat to fill their stone pots, lots of good warm caribou skins for clothing, and an ample store of blubber to keep their stone heating lamps flickering warmly. Their condition today, as reported above, after 40 years of peaceful penetration by white traders, tells its own sad story.

Twelve years ago this situation was already well on its way. Sergeant (now Inspector) A. H. Larsen of the Royal Canadian Mounted Police vessel "St. Roche," ice-locked in the Northwest Passage, told of visiting the Eskimos on Hovgard Island. "Their clothing," he stated, "was in a condition nearly impossible to describe, and it is unbelievable that they could live through the coldest parts of the winter in their poor clothing. All the snowhouses were visited, and very few had sleeping skins for their snow sleeping-platforms, as they had made them into clothing for the men in order that they could stay outside and tend the seal-holes. The old people and women were clothed in rags of deerskin, which were saturated with oil and dirt, this being all they had to sleep in as well. . . . The natives were on the ice all day looking for seal-holes. They had no blubber for their lamps—no fuel—and whenever a seal was killed, it was shared amongst the whole camp. . . . What little they obtained from the trading companies in exchange for their foxes does not amount to much even during the trapping season. When the season is over, few have anything else than ammunition and a few luxuries such as tea, flour, and tobacco."

What is the answer? These conditions are simply the outcome of the criminal destruction of the natural resources of this vast region and the merciless exploitation of the natives.

The privation began gradually but increased in intensity as the basic herds of, first, the musk oxen and then the caribou were destroyed by the introduction and indiscriminate sale of high-powered rifles. Limitless supplies of ammunition were bartered to natives whose philosophy recognized no relationship between the number of animals killed and the number left for future needs. Before the white man came, the Eskimos could not seriously reduce the supply of game with the weapons they had—harpoons, spears, and arrows. Further, they thought that the way to ensure enough food for the next season was to obey certain quite unrelated taboos and to perform the proper rites to please the spirits controlling the supply of animals. There was no reason to conserve game.

Firearms changed all this. But they did not change the Eskimo's economic philosophy. The gun did not carry with it a conservation policy. The man who sold it was also interested in selling the ammunition. So the Eskimos followed their ancient precept of aiming at every animal within range, and the slaughter began. At first there was jubilant prosperity, but the downward spiral of misery soon followed.

For four decades, the Eskimos of this area have been subjected to exploitation at the hands of certain traders and whalers. They have become the unfortunate victims of the "created want," as the traders aptly call their methods of enlarging their trade by creating in the minds of the natives a desire for things they neither wanted nor needed in the first place.

The traders wanted furs. But just so long as there were lots of caribou around, the Eskimo was independent of the trader's hardtack, flour, tea, and sowbelly, and he merely trapped white foxes when he felt so disposed. So, just as the United States Army officers defeated the warlike Plains Indians by encouraging the massacre of the buffalo, so did certain traders in more recent times deliberately encourage the wholesale slaughter of the caribou herds, the Eskimo's stand-by in time of need, to convert him into a trapper, dependent upon the trader and his store.

In the polar region beyond the Delta of the Mackenzie, it was the mammoth bowhead whale that introduced the spearhead of Caucasian commerce to the Western Arctic. The first bowhead was taken from these waters by the "Grampus," an American vessel, in 1890. Her entire catch for three seasons was 21 whales worth from $8000 to $10,000 for the largest. Her success quickly brought a fleet of other whalers north from San Francisco, until as many as 20 vessels wintered at Herschel Island. Whalebone was in great demand for use in corsets. In 1906, the discovery of a substitute caused the price of whalebone to drop from around $4.50 a pound to from 40¢ to 50¢, sounding the death knell of the whaling industry so far as the Western Arctic waters were concerned. Yet, the catch between the pioneer voyage of the "Grampus" and 1906 comprised 1345 whales, worth approximately 12 million dollars.

Some 2000 Eskimos roamed between the Alaskan boundary at Demarcation Point and Baillie Island in those days. And, with the adaptability that characterizes them, they had learned to make themselves relatively comfortable in a land that the white man, with all his scientific knowledge and inventions, had always shunned. From the snow they built warm houses, heating them with their primitive stone blubber lamps. From driftwood, bone, and stone they fashioned snow knives, awls, fishhooks, harpoons, and bows and arrows. From whale intestine and sealskin they evolved waterproof raincoats and boots. And with harpoons shod with detachable barbs of bone, some tribes pursued the bowhead whale in their skin umiaks for stores of meat and blubber.

To the traders and, to a lesser extent, the whalers, the exploitation of these so-called "Huskies" presented an annoying problem. For the Eskimos seemed quite satisfied with their own mode of life and wanted little that the white man had to offer save wood, knives, needles, pots, and axes. They considered fresh seal or caribou meat infinitely superior to salt pork. And they didn't see any advantage in exchanging their own warm, windproof clothing for shoddy cotton goods and sweaters imported by the whites. Furthermore, they didn't, at first, like the taste of either tea or whiskey.

From the trader's point of view, they'd have to be *educated* into wanting quite a lot of things that the whites manufactured before they'd be ripe for commercial exploitation. They would, for instance, have to be taught to discard skin coats and pants for overalls and sweaters. They would have to acquire a craving for tea, sugar, coffee, salt pork, and rum, which could be bought cheaply in Frisco and sold at an outrageous profit at Herschel Island. Only by creating such wants could these simple people be ensnared in the web of Caucasian commerce. So Alaskan natives, who had acquired enough

Photo courtesy Canadian Department of the Interior, Ottawa

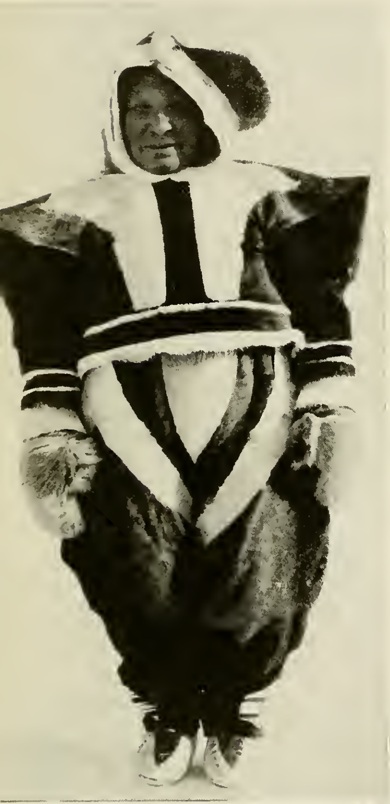
National Museum of Canada, Ottawa

NATIVE CEREMONIALS (above), rich in philosophical and spiritual meaning, are being forgotten. Emulation of the white man, illustrated by the store clothes and "Mother Hubbards" of cotton cloth at right, jeopardize the Eskimo's slender hold on his own cultural heritage white "culture" to make them ripe for any rascality, were imported into Canadian territory to help along the good work.

So effectively had commercial exploitation, with its accompanying epidemics, progressed by the time the first Northwest Mounted Police detachment was established at Herschel Island that the original Eskimo population of this region had been reduced from over 2000 to 400, which included many immigrants from Alaska.

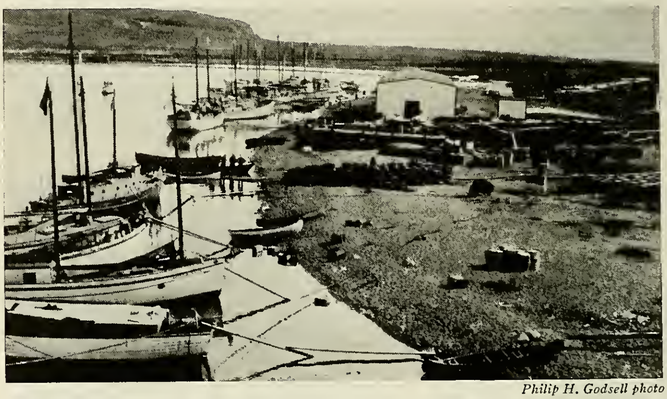
Simultaneously with the breakdown of the whaling industry, another era was ushered in. To the east lay the sealing grounds of the "Blond" Eskimos, as yet undiscovered. That Sea Wolf of the Arctic, Captain Klengenberg, made a piratical voyage to that region on the stolen "Olga," and five years later Stefansson reported the discovery of these Eskimos in the Northwest Passage, nearly 1000 miles east of Herschel Island. The news spread like wildfire. New "Huskies" to be exploited! A new race of savages to be taught the "benefits" of the "created want," to be shown how to pour a stream of furry wealth from the backs of white foxes and polar bears into the grasping hands of traders.

Soon the process that had demoralized the Mackenzie Delta Eskimos was being repeated in Coronation Gulf near the mouth of the Coppermine. Again Alaskan interpreters were introduced to help along the good work. On the shelves of trading posts, wrist watches, compacts, silk lingerie, and gaudy housedresses jostled tin kettles, nautical caps, unlimited supplies of ammunition, and high-powered rifles. Sloe-eyed youngsters were soon eating strips of rancid sowbelly rind instead of *maktak* (white whale skin). Stone Age ladies sported silk underwear,



Philip H. Godsell photo

▲ A "STONE AGE" Copper Eskimo, snug in her marvelously designed clothing of caribou skin. Her younger sisters prefer calico



Philip H. Godsell photo

2000 WHALERS once wintered at Pauline Cove, Herschel Island. Civilized weapons and ideas made some Eskimos "dollar-rich," but all grew poor in the resources essential to their remarkable culture. Below: The "St. Roche" of the Mounted Police, active against poaching on Eskimo preserves

▲ EVEN BUBBLE GUM has found the Eskimos. Will our other "blessings" make this lad happier than his grandfather?

P. W. Holzgraf photos

▲ ESKIMO TWINS of Norton Sound, Alaska. Many exciting things are in store for them, but will there be enough game?

French-heeled shoes, and hideous Mother Hubbards of green, yellow, and purple-striped bed ticking. Winchester rifles, costing around $30 and selling for from $600 to $800 apiece (12 to 20 white fox pelts, to be exact, which were then worth around $50 apiece), replaced the far less destructive harpoon and bow and arrow. The shoddy sweater and cotton parka ousted the less fashionable fur *attegi.*

Armed with a modern repeating rifle, the destructiveness of the average Eskimo was increased a thousandfold. There was lots of ammunition in the store at $25 a box, and the white man gave his blessing to go and kill caribou and to trade in the worthless summer skins. At Tree River Post, in 1923, I counted 18 enormous bales of worthless and wormy summer caribou skins which had been bought from the Eskimos at 75¢ apiece, solely to encourage the killing off of the caribou. I remonstrated with the man responsible for this policy. How could he justify such wanton slaughter for so small a profit? Ultimately the policy could only have a ruinous effect on *both* the Eskimos and the trade. But he merely laughed. "As long as there are lots of caribou around," he contended, "the Eskimos won't trap. Once the caribou are cleaned out, they'll be dependent on imported provisions and clothing. Then they'll *have* to trap white foxes. It's the foxes *we* depend on for our trade!"

From the very first, the rifle had proved the best and most profitable seller. But, at last, each Eskimo owned one, and the trade had reached the saturation point—a fact deplored by every trader. It was Captain Klengenberg, according to Corporal Doak of the Mounted Police, who rose to the occasion with characteristic shrewdness. He imported hard steel ramrods and gave them to the natives, telling them to scrape the inside of their rifle barrels freely to "take the powder out." Soon the rifling was destroyed, the Winchesters would "shoot around corners," and the erstwhile sale of rifles was resumed!

Meanwhile the foundations of vigorous health were undermined by imported food and clothing, and the once healthy Eskimos fell heir to tuberculosis, intestinal ailments, influenza, tooth decay, and a dozen other maladies that had been either mild or unknown before.

Admittedly there are ample precedents to indicate that it is unsafe for men to depend on the unpredictable movements of the caribou. This is attested by the tragic death of the Hornby party near the junction of the Thelon and Hanbury Rivers in 1927, the loss of "Blackie" Lanners in the Snowdrift country the following year, and by the frequent reports of cannibalism among the natives in the old Journals of the Hudson's Bay Company and elsewhere. Yet the annual migration has long been a major factor in the lives of both the Eskimos and the Indians of the North. The mighty caribou herds still approximated 30 million when I stepped ashore at York Factory, on Hudson Bay, in 1906. For untold centuries they had migrated with more or less regularity across the Barrens, a living ocean of dun-colored bodies, an undulating forest of tossing antlers, as far as the eye could see. Reaching the Arctic coast, the females crossed by certain regular crossings to the Arctic islands to do their fawning. Returning to the mainland, they joined the bulls at the commencement of the mating season and began their southward migration in time to reach the timber —the Land-of-Little-Sticks—before the snow flew. Lying in wait at these crossings, the Eskimos had been in the habit of killing enough animals with their bows and arrows to furnish them with meat and with skins for winter clothing. Armed with the death-dealing repeating rifle, it was no longer a killing but a massacre!

Suddenly the caribou failed to put in their customary appearance. Frantically the Eskimos appealed, first to their medicine men, then to the Reverend Girling and W. H. B. Hoare of the Anglican Mission at Bernard Harbour. So wrathful did the natives become when the missionaries were only able to promise them "lots of caribou in the Hereafter" that Staff Sergeant Sid Clay and Corporal William Doak of the Mounted Police were forced to intervene. To avoid bloodshed, they conveyed the two protesting whites to a place of safety at Stapleton Bay.

But the damage had been done. The opening up of the Athabasca-Mackenzie waterways system to large-scale transportation, following the completion of the Alberta and Great Waterways Railway to Fort McMurray in 1920, had also furnished the Chipewyan, Caribou-eater, Slavey, Yellowknife, and Dogrib tribes with high-powered rifles in place of the time-worn muzzle-loader, together with unlimited supplies of ammunition. Prior to that, it had been both costly and difficult to bring in cartridges and other weighty articles by scow to such then-isolated posts as Fort Resolution and Fort Rae. Consequently, ammunition had been sold sparingly and valued proportionately. And, in those days, I have known a trader to refuse to sell an Indian even a full box of cartridges but to allow him only ten. Improved transportation, and competition from the now defunct Lamson and Hubbard Company, changed all this overnight, and the Indian, like the Eskimo, was able to buy his cartridges by the case if he so desired.

Encircled by irresponsible Indians and Eskimos, all armed to the teeth by the traders, the caribou were depleted from some thirty million to a scant three million. The Eskimo, in debt, had no alternative but to beg the trader for white man's grub. So he became the white man's slave, a trapper of white foxes with a mortgage on his fur catch.

In two decades the Coronation Gulf Eskimo had been made over, streamlined and converted from a free hunter-fisherman into just another cog in the soul-crushing treadmill of the white man's voracious commerce; dependent now on credit, sowbelly, and sweaters—his friend the caribou almost a tradition of the past.

So rapidly were these Eskimos succumbing to the white man's much vaunted but greatly overrated "civilization" and his "created want" that their ultimate destruction seemed inevitable. Urged by myself and public-spirited residents of the North, the Government belatedly stepped in. Preserves were set aside for the exclusive use of Eskimo hunters. White trappers and traders were politely but firmly forced to move over from the Arctic islands to the mainland. Andy Bahr made his epic trip across the Arctic Rockies from Buckland Point, Alaska, to Richards Island at the mouth of the Mackenzie, herding 3000 domestic reindeer from the Loman reindeer herds in an effort to alleviate the situation.

In the meantime, and during those seven-year periods when white foxes almost completely disappear from the Arctic, the Eskimos were strictly up against it. They have become anxious recipients of Government bounty in the form or relief to take the place of the caribou and whale meat of former days. Today, as trappers, they are dependent on the uncertain run of the white foxes and the temperament of the trader. When foxes are scarce—and, as is the case at present, when fur prices and the market are demoralized—traders aren't apt to be very openhanded.

I also stated through the press twelve years ago, again forecasting these very conditions: "With the door of the trading-store banged in his face, the empty-handed Eskimo will have an opportunity to realize that he, like the Indian, has bartered his birthright for a mess of pottage, and that the 'created want' has proven a boomerang indeed!" Alas, these words were all too true.

The remedy is not yet in sight. It has been suggested, at times, that all trading operations in the Arctic should be taken over by the Government and operated under methods similar to those employed by the Danish Government with the Eskimos of Greenland, that is, on a noncompetitive basis, with the profit urge eliminated. Primarily, a further effort might be made to increase the basic herds of caribou, which are as important in Eskimo economy as were the buffalo to the Plains Indians. This might be achieved by enlarging the game preserves on the mainland, limiting the sale of ammunition to natives, and enforcing closer supervision of the slaughter of caribou not only by the Eskimos but by the Indian tribes of the Mackenzie, Athabasca, and Churchill River regions.

The Eskimo cannot make these things happen. It is necessary for intelligent people to keep informed on this urgent problem and bring about the proper legislation that will save the Eskimo.

Who thought of it first?

Some of the most dramatic coincidences of history have occurred when two or more persons invented the same thing at the same time—as the great inventor Leonardo da Vinci, who was born exactly 500 years ago, might be bemused to observe

By BENJAMIN MELNITSKY

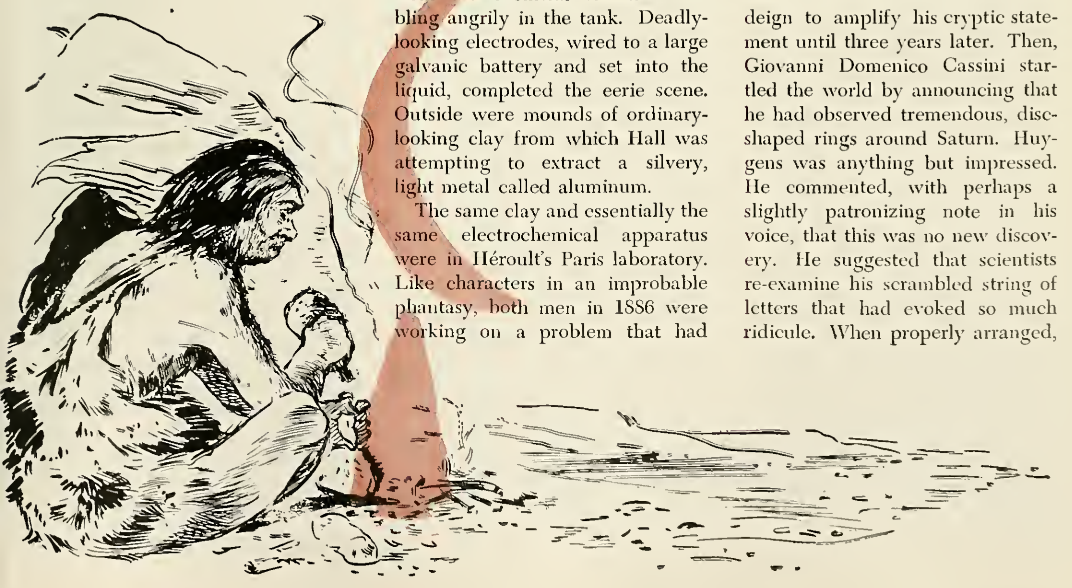
"SIMULTANEOUSLY and independently," or words to that effect, describe the origin of countless inventions and discoveries. The machine on which this article was typed, the typography by which these lines were printed, the photographs and line engravings that illustrate these pages, even the presses that printed the magazine—all stem from inventions developed independently and often simultaneously by two or more persons.

If you are an inventor and unexpectedly come face to face with the identical twin of your brain child, it is more than mildly amusing. It's often downright baffling. Certainly there was more than ample reason 66 years ago for Charles Martin Hall and Paul Louis Toussaint Héroult to have stared at each other in open-mouthed amazement.

Hall's crowded workshop at Ohio's Oberlin College lacked only the three witches to make it the perfect setting for the "bubble, bubble, toil and trouble" scene from *Macbeth*. Occupying the lion's share of room space was a cast-iron tank heated from below by a smelly gasoline stove. Fumes rose from the chemical solution bubbling angrily in the tank. Deadly-looking electrodes, wired to a large galvanic battery and set into the liquid, completed the eerie scene. Outside were mounds of ordinary-looking clay from which Hall was attempting to extract a silvery, light metal called aluminum.

The same clay and essentially the same electrochemical apparatus were in Héroult's Paris laboratory. Like characters in an improbable phantasy, both men in 1886 were working on a problem that had baffled top-notch scientists for over 50 years. Yet, fired with an equal degree of determination, both succeeded at about the same time. Thirty years earlier "silver from clay," as the metal was then called, cost $272 a pound. Shortly after the duplicate discovery, aluminum products were standard items at the five-and-ten. Born in 1863, Hall and Héroult died within a few months of each other in 1914.

In 1656 Christiaan Huygens published in a scientific journal the following notice: "aaaaaaa ccccc d eeeee g h iiiiii llll mm nnnnnnnnn oooo pp q rr s ttttt uuuuu." The stolid Dutch astronomer did not deign to amplify his cryptic statement until three years later. Then, Giovanni Domenico Cassini startled the world by announcing that he had observed tremendous, disc-shaped rings around Saturn. Huygens was anything but impressed. He commented, with perhaps a slightly patronizing note in his voice, that this was no new discovery. He suggested that scientists re-examine his scrambled string of letters that had evoked so much ridicule. When properly arranged,



he explained, they announced in Latin precisely the same finding. (His statement read: "Annulo cingitur, tennui, plano, nusquam cohaerente, ad eclipticam inclinato.") Huygens had been playing it safe. He wished to establish priority for the discovery without risking his reputation. In this he out-foxed himself. Astronomy books credit first knowledge of the rings about Saturn to Huygens *and* Cassini. They record as a triplicate discovery the next important Saturnian finding.

With his myopic telescope, Cassini could only see two of Saturn's rings. The third one was observed in 1838 by Johann Gottfried Galle, who published his finding, not in a cryptic mumbo-jumbo script, but in precise German. Nonetheless, his discovery was completely forgotten until rediscovered—independently and simultaneously—twelve years later by William Cranch Bond at Harvard and W. R. Dawes in London. As if in compensation for having had to share his discovery of Saturn's third ring, Galle was the very first to observe the new planet Neptune.

Halley's Comet in 1835 did more than scare the populus half out of its wits. It demonstrated to astronomers that Uranus was not following the course around the sun charted for it by mathematicians. Something was peculiar in Uranus, and in 1843 the Royal Society of Göttingen offered 50 ducats for a sensible explanation. Almost two years went by and the prize was unclaimed. Then, in the early part of November, 1845, John Couch Adams at Cambridge, England, and Urbain Jean Joseph Leverrier in France offered the same explanation, based on identical mathematical calculations. They announced that the travel eccentricities of Uranus must be caused by the gravitational pull of an unobserved planet located about a billion miles farther from the Sun.

The trolley car, typewriter, telegraph, television, and telephone—to mention but a few of the inventions beginning with the letter "t"—were each the brain child of many parents. The trolley car, for example, was invented by Van Doeple, Daft, Sprague, and Siemens. This is on the authority of Ogborn and Thomas, who in 1922 tabulated no less than 148 multiple discoveries and inventions. They did not list all the important examples or even consider minor ones. The full extent of duplication in invention was indicated by Joseph Rossman, a past Patent Office examiner. "At least four percent of the patents filed each year," he pointed out, "contain multiple inventions." On the basis of this conservative estimate, well over 100,000 patent applications since 1900 have been rejected for reason of duplication. Many times greater is the figure for patentable ideas that die prematurely. John Doe creates what he considers an earth-shaking, new invention. His dreams of world acclaim as a latter-day Edison end with a visit to his patent attorney. "Sorry," he is told, "someone beat you to it."

In modern times it sometimes looks as though there have been almost as many multiple inventions as inventors and almost as many parallel discoveries as there are scientists. In earlier eras, the question becomes more difficult to answer. The archaeologist studying prehistoric man from the jigsaw puzzle of broken pottery, fragments of ornaments, and bits of tools is continually coming up against the puzzling and disturbing possibility of overlapping inventions.

Take such a down-to-earth item as the pipes played so persuasively by the Greek god, Pan. Bullfinch generously credits this goateed, goat-footed character with the invention of this musical instrument. Anthropologists are of a different opinion. Panpipes, they explain, are far too widely distributed. They occur in such distantly separated areas as Southeast Asia, Indonesia, Melanesia, and parts of South and Central America. According to one report, someone recently obtained several of these instruments from the Solomon Islands and Brazil and checked the vibration rate, or pitch. The comparative readings were identical for two of the four tubes in each pipe, and the others were so close as not to make a significant difference. Except for the pipes, there is little in common between the Solomon Islands and Brazil. Culturally, they're poles apart. In language, for example, pure Brooklynese and Pre-pyramid Egyptian are no further apart. Yet, for some inexplicable reason, the Pacific aborigine and this South American Indian tribe have for untold centuries tooted similar tunes on fantastically identical instruments.

Coincidence labels rather than explains the phenomenon of duplication. Economists and historians ponder over the subject and speak of "social compulsion," of necessity mothering invention. Many anthropologists admit the likelihood of independent invention in the basic tools and methods primitive man developed early in his history. They speak of "parallel or convergent development." They see in the process of cultural evolution the possibility that similar needs and similar resources may have led to identical or almost identical spears, bows, or war clubs in widely separate areas.

Other anthropologists go to extreme lengths to explain things through "diffusion," taking the stand that independent invention in primitive times was rare or nonexistent. These scholars do not admit the possibility of the same implement being invented twice unless it seems quite impossible to argue that the idea might have spread from a single point of origin.

The extreme diffusionist is not disturbed by the fact that blowguns have been found in Africa and Indonesia as well as in the tropics of South and Central America and in Southeastern United States. The instrument is an exceedingly useful one, and if given time, it might have spread from tribe to tribe around a good portion of the globe. The diffusionist doesn't let it trouble him that Indians living in California centuries ago wove baskets by the same methods used by certain African tribes.

On first glance, one might say that if so elaborate a machine as a trolley car could be invented simultaneously, it is no stretch of the imagination to suppose that a simple primitive tool might also. But the question is not so simple. Our inventions, though intricate, are the outgrowth of an elaborate technological background and knowledge readily available to many inventors. And the various inventors are all aware ,of the same public needs. Inventing in Stone Age days must have been quite a different matter, with few materials to work with, no records of previous efforts to follow, and no way of knowing how another hunter a few hundred miles away might have solved a related problem. Duplication of a relatively simple invention on that level of life might be much less likely than duplication of a complex machine or process in our civilization. But no simple rule can be formulated for guessing whether a primitive invention was hit upon more than once or whether the idea traveled from place to place and tribe to tribe. Time, of course, is a consideration in relation to distance and geographical barriers. The cautious anthropologist is frequently uncertain unless a combination of arbitrary features of construction or embellishment make it statistically improbable that chance could have caused a coincidence.

The "bull roarer" is a slat of wood tied to the end of a thong or cord, which can be whirled to produce a deep muffled sound. Primitive people in widely separated parts of the world have used this, particularly in religious rites. It is known among various African and Australian tribes, in certain marginal tribes in South America, and in the Southwestern United States. If you argue for a single origin, the apparent antiquity of this instrument may help ease the strain of explaining its presence in such widely separated places. It may date from as far back as Paleolithic times.

Whichever theory you choose, you may be sure that the roar of the bull roarer and the often shrill arguing among scientists as to the true explanations for duplication are a baby's whisper compared to the sound and the fury of the inventor who finds his ideas patented by others. He thinks back to the months and often years of wasted effort. He tends to be a trifle less dispassionate than is seemly. Not infrequently, he rises on his hind legs and yells "*Thief!*" And his answer to duplication has sometimes been duplicity, dishonesty, and dirty-dealing.

On the other hand, the famous Dr. Sanford A. Moss was joking when he declared, "I was convinced that Barker had stolen my invention." Dr. Moss is perhaps best known for the development of the turbosupercharger. With this booster device, Flying Fortresses could attain altitudes of 35,000 feet; without it, top ceiling was 20,000 feet. He has many other notable inventions to his credit; yet, his pride and joy has always been his first-born, the gas turbine he perfected while still at college. Many years later he learned that *his* turbine had been patented by an Englishman named John Barker. That Dr. Moss was joking is evidenced by the date of Barker's patent—1791.

Alexander Graham Bell was also accused of thievery, not to the tune of good-natured joshing but to the costly strains of 600 lawsuits, five of which reached the United States Supreme Court.

On March 10, 1876, Bell shouted into a crude electrical device, "Mr. Watson, come here, I want you." Thus, history books and motion pictures relate, the telephone was born. Near the entrance to Ballou Hall at Tufts College in Medford, Massachusetts, is a plaque that states otherwise. Inscribed there in bronze are the words:

AMOS EMERSON DOLBEAR

Professor of Physics
1874-1906
Inspiring Teacher—
Creative Inventor
Within These Walls Professor Dolbear Invented in 1876 the First Permanent Magnet Telephone . . .

In Italy, similar bronze tablets honor Antonio Meucci. In a Munich museum sits the Germanic version of the first telephone—this one invented by Philip Reis. At the 1899 International Exposition in Paris were two medals, one for Professor Elisha Gray and the other for Alexander Graham Bell. Each medal proclaimed its recipient as the inventor of the telephone. Although less honored, the numerous other telephone firsters were no less persistent in voicing their claims. Here was duplicate discovery with a vengeance. Yet, despite the accusations of dishonesty and the legal squabbling, it is fairly certain, at this late date, that Bell, Gray, Dolbear, and possibly several other inventors did develop essentially the same electrical instrument at essentially the same time.

Duplicity does not explain the telephone duplication. By 1876 this invention was as inevitable as the discovery of low-cost aluminum refining was to have been ten years later. This was stated very nicely by an engineering journal on the occasion of Charles Martin Hall's death: "People wonder why Héroult and Hall should have found the same process of reducing aluminum simultaneously and independently in France and America. They might just as well wonder why it rains simultaneously in two places, if the air is oversaturated with water vapor in both. Humanity was ripe for the birth of industrial electrochemistry, and the intellectual atmosphere was oversaturated with the idea of its possibility. Destiny's problem was to find the men who would be the nuclei of condensation."

Technological progress follows the evolutionary pattern of crawl-walk-run. Scientific knowledge accumulated over many years may, at a certain point, give rise to a "flash of inspiration" in the minds of several men. Thus in 1608 the science of optics had advanced sufficiently so that the telescope could be invented by Galileo, Drebbel, Jansen, and several others. More recently, the first mechanical system for transmitting and receiving television images was invented simultaneously in 1926 by Baird in England and Jenkins in this country. Present-day all-electronic video is in large measure the result of parallel work by P. T. Farnsworth and V. K. Zworykin.

Strangely enough, the most remarkable instance of the evolutionary process in duplicate discovery is none other than Darwin's theory of evolution.

The brilliant concept that new animal and plant types result from gradual changes came to Charles Robert Darwin during his five-year round-the-world voyage on H. M. S. *Beagle*. Seven years after his return to London, Darwin expounded his theory of natural selection in a 231-page essay. He did not publish it. Sir Arthur Keith gives the reason: Darwin believed that "he was in possession of a secret of momentous import—and so unholy that he determined to say nothing of it until he had attained complete certainty." This self-imposed secrecy was maintained for twenty-one years. At the end of this period, Darwin had little more to show for a lifetime of steady work than a tremendous accumulation of research data and notes on his experiments. In the third week of June in 1858, Darwin received in the mail a bulky envelope postmarked Ternate, a small island in the Malay Archipelago. He pushed aside his notes on the first chapter of his *Origin of Species* and examined the envelope. The sender, Alfred Russel Wallace, was a total stranger; not so, the short manuscript in the envelope. It repeated, in condensed form, the ideas that had been brewing secretly in Darwin's mind for the past 20 years. Wallace's work was an almost perfect abstract of the book Darwin was that very day writing.

The birth of the doctrine of evolution illustrates the manner in which many inventions emerge—apparently suddenly—but from a fertile field where they have actually long been germinating. The intellectual atmosphere in the nineteenth century was oversaturated with a sense of dissatisfaction with the theological explanation of man's origin. Incontroversial facts simply did not fit into the idea-mold of a world created in six 24-hour days. Inquiring minds the world over had formed the elements which, when combined, would result in the revolutionary theory of evolution. It so happened that two men, Darwin and Wallace, managed to fit together the pieces at the same time.

Even when the underlying principles are known, an invention is not produced for general use until materials and techniques make its manufacture economically feasible. And it is not accepted into general use until society is ready for it. Most of the basic principles necessary for the construction of a device to cut grain mechanically were available when the prophet Isaiah foretold that "they shall beat their swords into plowshares and their spears into pruning hooks." Yet, the first successful reaper was not perfected until 1833 and then by Cyrus Hall McCormick *and* Obed Hussey. The reason for this and other duplications in farm equipment was elucidated by Edward C. Kirkland in his study of American economic life: "America's most original contribution to the agricultural revolution was the invention of agricultural machinery. It would be pleasing to presume that this pre-eminence was due to superior inventive capacity of the American mind, but, as a matter of fact, it sprang from the necessity of American agriculture."

Necessity mothers not only single inventions but twins and triplets and an occasional quadruplet. Back in 1860, manufacturers of pool and billiard equipment were—to use a more modern expression—behind the eight-ball for want of ivory. A $5000 prize was offered for the best substitute material. Although John Wesley Hyatt failed to win, he did develop cellulose nitrate (Celluloid), the first of the plastics. Unbeknownst to Hyatt, the same substance had been invented a few years earlier by Alexander Parkes of Burry Port, Wales. Within 20 years after Hyatt had been granted U. S. Patent 88,634, well over 25,000 patent applications relating to Celluloid were received in Washington. Needless to say, many were duplicates.

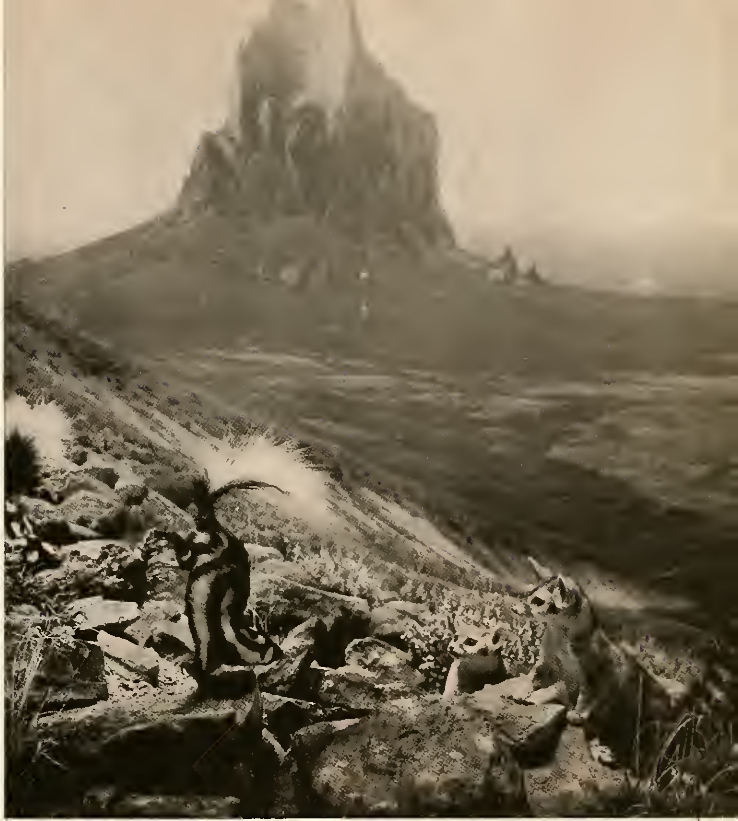
Each major invention creates a need for further inventions. Television brought with it aerials for improved reception and special devices to rotate them, boosters to perk up incoming signals and filters to tone down screen images, sofas that curve around the set and tables that conform to the sofas' contours —and so on ad infinitum. Many of these television offsprings have been developed simultaneously and independently by two or more persons.

The investigator's curiosity sometimes overrides the theory of necessity. Were inventors the type of solid citizen to be found on the 9

A. M. commuter special, duplication would be a simple matter indeed. Unfortunately—for the theorist, at any rate—inventors are strange folk who, for lack of a better name, are designated geniuses. Sometimes they are far ahead of technological evolution in terms of materials and tools for manufacture; sometimes they are ahead of society's readiness to put their ideas to work. Such a man was Leonardo da Vinci. At a 1940 exhibition in New York City, models of 300 Leonardo inventions were displayed. These included a workable parachute, the forerunner of today's helicopter, and variable speed drives similar to those used in automobiles. His active mind touched on all phases of the mechanical sciences, and in each he came up with startling discoveries which were reinvented centuries later. Four hundred years before the battle between the iron-clad *Monitor* and *Merrimac*, Leonardo had designed a workable armored vessel. Also anticipated by him were the alarm clock, steam shovel, machine gun, air-conditioning, the textile weaving machine, and literally hundreds of others. One reason why these inventions and discoveries were not revealed to the world lies in the strange habits of this genius. Leonardo da Vinci left his treasured knowledge in the form of manuscripts that he wrote from right to left, with the left hand, and back-handed.

Edison also exemplifies the unfettered individual who operates beyond the limits of societal needs. His active mind brought forth enough ideas to produce 1097 patented inventions and to overflow into the 2500 notebooks he left as a legacy to the world.

The phenomenon of duplication, the strange overlapping of events,—these are most evident in those phases of history having to do with invention and discovery. Theories can, at the very best, offer only partial explanation as yet, but the findings of archaeology and historical research are continually adding to the story of man's ingenuity in action through the ages.



"Spotty" and "Ring-tail"

The American Museum's Hall of North American Mammals would not be complete without our familiar friend — the Skunk. Here we see the little spotted kind, with the Cacomistle, against the background of New Mexico's landmark, Shiprock

THE posture in which this Rocky Mountain Spotted Skunk *(Spilogale tenuis)* is exhibited apparently can be taken as a warning. This little skunk can defend itself as its larger relative can by means of "chemical warfare." It assumes this attitude when confronted by an approaching enemy and may even take some steps on its front paws. It is much more active than the Striped Skunk and even climbs trees on occasion. Its total length is about a foot and a half.

The Texas Cacomistle *(Bassariscus astutus)* shown here is about 32 inches long and weighs approximately 2½ pounds. Its closest relative is the raccoon, but it is much smaller and more slender. It readily climbs and sometimes makes its den in a hole in a tree but more often in a cave among rocks.

Shiprock, rising to 1400 feet above the surrounding plain is a huge "volcanic neck" formed in the throat of a volcano some five million years ago. The slopes of the volcano have long since been weathered away, leaving only the mass of rock cemented by lava, which plugged the tremendous volcanic vent.

Galloping Ghosts of the desert

With the jump of a kangaroo and a tail considerably longer than its body, the little Kangaroo Rat will prove itself one of the most endearing creatures you might befriend

UNTIL three years ago, *Dipodomys* was not even a word in my vocabulary. Simply, I had never even heard of this unusual animal. Since then I have read in *Reader's Digest* of his cousin, the jerboa—the jumpingest creature on earth. But in the autumn of '49, I did not recognize that strange flash of sand-colored animation I saw from the window of our trailer, parked far out in the Colorado Desert.

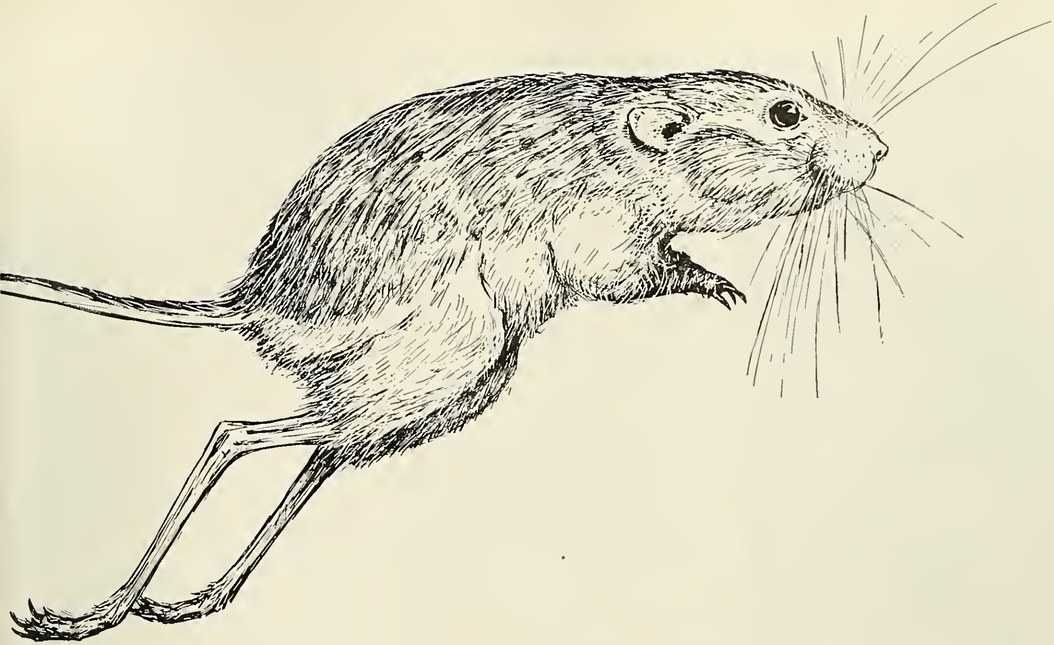
In fact, I could not have sworn I had seen anything at all. A "dip" blends perfectly into its desert background, and he either moves with incredible speed or freezes instantly into immobility. Even yet I have difficulty in following the course of one across the desert.

I was to learn that the dip is among the shiest of God's creatures, can proportionately outjump even the kangaroo, and in various deserts his relatives may have varying names—such as jerboa or kangaroo rat.

Months later I was to discover that the dip is also a very friendly little fellow and one that definitely improves with acquaintance. However, it took me five months really to make friends with a single one of this species, and another two years to win the confidence of three score of them—all living in their free, wild state. Of course I did not trap or shoot them.

Now, when I finish my morning's stint of writing, I thoroughly enjoy making the rounds of the dip warrens in my vicinity and calling these silky-coated creatures up for something to eat and a visit. Considering that most of my rounds are made in midwinter afternoons, it is really nice of these nocturnal fellows to wake up at the sound of my voice and at once show themselves.

Of course I appreciate that their primary interest is not in me but in the nut meats, bits of apple and carrot, and pieces of dried bread that I give to each of them. Nevertheless, they respond to no voice



By

MORLEY COOPER

Drawings by Matthew Kalmenoff

but my own and, having learned not to fear me, will run up my leg and perch on my shoulder while I feed them.

I have been able to instill similar confidence in a wild chipmunk in a matter of but three or four days. But it takes months of patient effort really to get acquainted with a Dipodomys. Eventually, however, this effort is richly rewarded when, at your hail, as many as four sleepy heads appear at adjacent burrow mouths in a single warren. These four are likely to be mother and her young, since adult dips appear to maintain separate warrens except at mating time.

Dips have proportionately gigantic jumping legs and rather small forelegs. They get about by leaping, "cruising" with hops of a foot or so, which may suddenly lengthen into jumps up to fourteen feet when they become frightened. Naturalists tell me the dip's maximum hop is comparable to a man's jumping 200 feet.

Ordinarily my dips just mosey along, but if a hawk or owl shows itself, they head for the nearest burrow at a speed faster than my eye can follow. At such a moment they appear literally to vanish in mid-jump.

They are acutely conscious of anything that flies (even airplanes far aloft disturb them), and they also have to be concerned about certain enemies while they are underground. However, they must be too smart for most of these predators, since in three years I have never lost a single dip in a region infested with both diamondbacks and sidewinders. Neither do the foxes or badgers appear to have much success in digging out these dips, although they occasionally work furiously at the task.

Their failure is understandable once you attempt to explore a dip warren. Last January, I missed one of my favorite dips for three days, and since none of them ever hibernated while I was thereabouts, I became concerned about him. So I shoveled back into his burrow—and at once ran into such a confused system of tunnels, branching every which way, that I had no idea where he might be.

I am convinced that any burrowing animal, even if it possessed a keen sense of smell, might well be puzzled as to which way to dig. And in the meantime, if I know the dip, he would be quietly moving far, far away. Furthermore, their burrows are not all interconnected beneath the ground. Sometimes there will exist three or four isolated networks within a single warren.

Three weeks later I happened to encounter that missing dip a quarter mile away, where he had dug a brand-new set of interbranching burrows. Why he made this sudden move in midwinter I will never know.

Recognizing individual dips becomes easy. As a matter of course, you name each one as soon as he "shows." Thereafter the problem becomes that of thinking up enough names to go around—simple names such as Jimmy, Susie, Sooky, Butch, Teeny, and Skippy. The surprising thing to the amateur naturalist is that you learn early to identify each dip positively, no matter where you happen to encounter him. This recognition is not entirely based on appearance, although obviously there exist many different kinds, as regards color, size, and markings.

▲ THE AUTHOR feeding a tame dip. He says that your first casual, friendly words at 30 feet will scare the animal half out of its wits. But patience is rewarded in dip-taming. In time, the little creature will climb right up your clothing

You also encounter much individuality in behavior among dips.

Dips are restless fellows. In the mating season this is understandable. But in the dead of winter a dip may decide to abandon a comfortable, well-stocked warren for no apparent reason and casually move half a mile away. In that event, I usually run across the fellow a week or so later, when he will welcome me but at the same time contrive to register his displeasure that I have been neglecting to feed him since his disappearance.

This lack of logic is exasperating, but the dip makes up for it at other times. I have never known keener enjoyment than when I sing out for a dip and he pops out of his hole and comes tearing across the desert in my direction, his long, bushy-tipped tail meanwhile thumping madly on the packed sand as he covers ground with unbelievable speed. (That long tail appears to give him a sort of three-point landing and compensates greatly for the uselessness of those tiny forelegs.)

Six feet away, the dip usually stops dead and freezes there. Those shoe-button eyes study me unblinkingly. Then I speak again, and at once the little devil will take off on a tremendous jump that lands him halfway up to my shoulder. Thereafter he scrambles rather awkwardly the rest of the way and immediately looks about for something to eat. No matter what you give him, he seizes the morsel gently between his tiny forepaws, then grips it in his teeth, and for a moment sits quietly while he runs his tongue over the tidbit. Then he suddenly takes off, springing far out into space. He lands six feet away and at once flashes down his nearest burrow. Within a minute he reappears for a repeat performance.

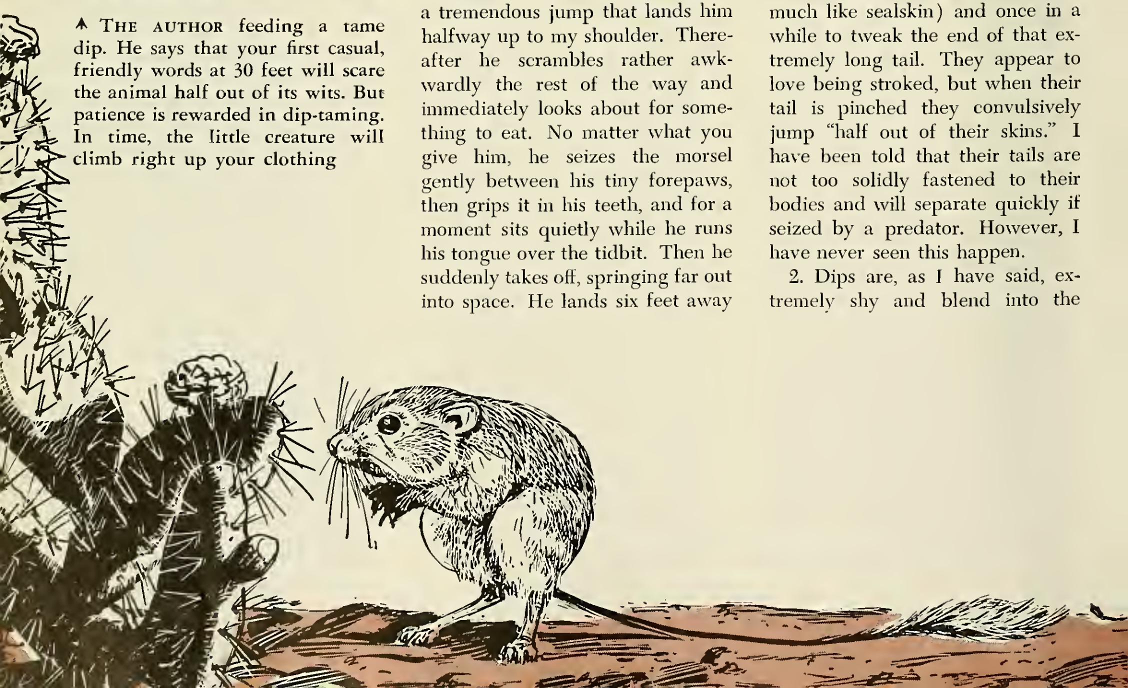
He has burrows everywhere and usually needs to move but a few feet to reach the opening of one. Invariably, however, at least two of the holes in any warren are dug at the base of a greasewood bush, and I have wondered whether the dips derive moisture from the roots. I have never been able to persuade one to drink water from a pan. On the other hand, when they have plenty of juicy apples and carrots, they seldom visit those greasewood burrows.

If anyone in the arid sections of the Southwest is interested in getting acquainted with dips in their wild state, I can make a few suggestions, based, of course, solely on trial-and-error experimentation.

1. Never attempt to handle or in any way restrain a dip, even though he eventually deigns to hop on your knee or shoulder. They love their freedom more than they do any tidbits you may bring them, and will vanish for good if you try to seize them. Also, they will bite viciously if they are frightened.

The farthest I have ever gone in familiarity is to gently stroke their unbelievably soft, silky fur (it is much like sealskin) and once in a while to tweak the end of that extremely long tail. They appear to love being stroked, but when their tail is pinched they convulsively jump "half out of their skins." I have been told that their tails are not too solidly fastened to their bodies and will separate quickly if seized by a predator. However, I have never seen this happen.

2. Dips are, as I have said, extremely shy and blend into the



desertscape. I have talked with soldiers who were stationed for months in desert camps in which dozens of dips had their being, yet these men never glimpsed a dip, even when on night sentry duty.

The best time to meet a dip is after sundown, not long before dark. It is then they most like to come up, sometimes to look for food, sometimes just to stretch their legs. Occasionally they appear to want just to play. Their favorite sport appears to be that of nipping one another's tails, getting pleasure out of watching the bitten one jump.

3. If you wish to "tame" a dip, take your time about this. Begin by leaving a few pieces of dried bread crust or nut kernels in the evening near the entrance of an active burrow (one that shows fresh digging at the entrance each day). After about a week of this, station yourself 30 feet from the burrow and quietly await the dip's appearance. As soon as he appears and begins lugging the tidbits below ground, speak to him in a casual, friendly tone.

4. At first this will scare him half out of his wits. But by the following evening he will begin to become accustomed to your presence. Thereafter you may approach a bit closer each evening until, many days later, the dip will deign to accept food from your hand. By then he has decided you are all right and have no evil intentions, so far as he is concerned.

From then on it is not difficult to persuade the dip to hop on your knee and to "show" when you call, either in the evening or—later on—even at midday. Still later you may introduce human beings to him, and he will accept them as friends so long as you are among those present.

Conceding that the dip is just another burrowing rodent, you nevertheless soon dislike hearing him classified as "rat." I have never seen any indication of disease among these dips or discovered a flea of any sort. Further, they have a score of individualistic traits that make them both amusing and (at least to this observer) lovable.

On the other hand (just to keep this report objective), the dip has a few habits I dislike. For one thing, even after he comes to know you, he is altogether likely to dive unexpectedly into his burrow and promptly kick a shower of sand and gravel into your face. He burrows with those powerful jumping legs and can throw a teacupful of dirt in your face before you can dodge. Thereafter, while this suspicious fit lasts, he sulks below ground and drums his right hind leg in a staccato of warning or defiance.

Again, if you feed the dip regularly, he stores much of this food underground, burying it in the dry sand. When he at last comes to feel affluent, he is likely to take you more or less for granted and fail to register proper appreciation of the food you bring. You then become something like the milkman or the Good Humor man—the dip expects you to appear each day and will register disapproval if you do not show up.

Nevertheless, during three winters' acquaintance with these little fellows, I have found them most fascinating neighbors. Also, I have recently noticed a curious phenomenon that I cannot explain.

Each winter I park my trailer in the center of an area of about half-a-million acres of unfenced desert "waste." The first season there, as I have said, I became acquainted with upward of a dozen dips.

The next winter, however, there were more than a score of dips in the 100 acres or so immediately adjacent to our campsite.

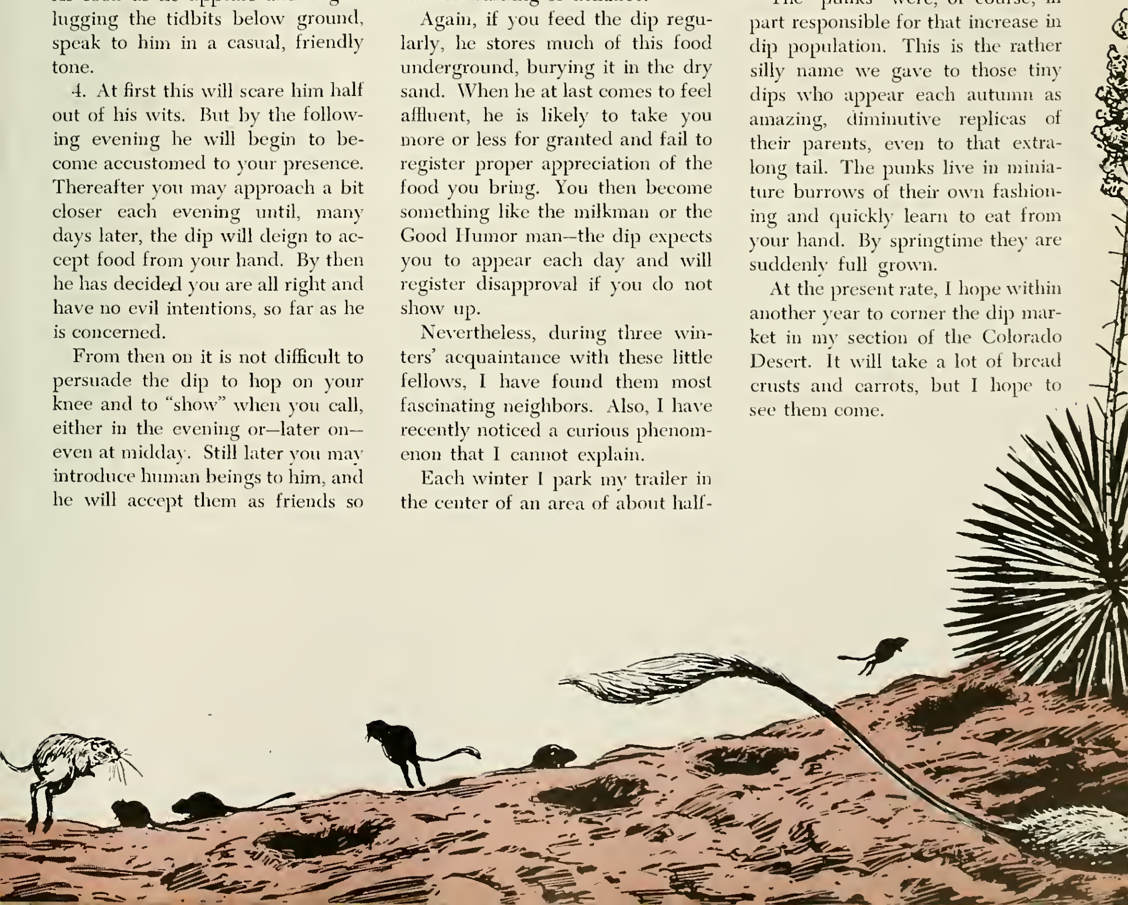
The third winter this gathering of the clan took quite a jump. As many as 50 dips quietly moved into our immediate vicinity. But in a day's hike of many miles, you rarely saw fresh dip signs beyond this radius.

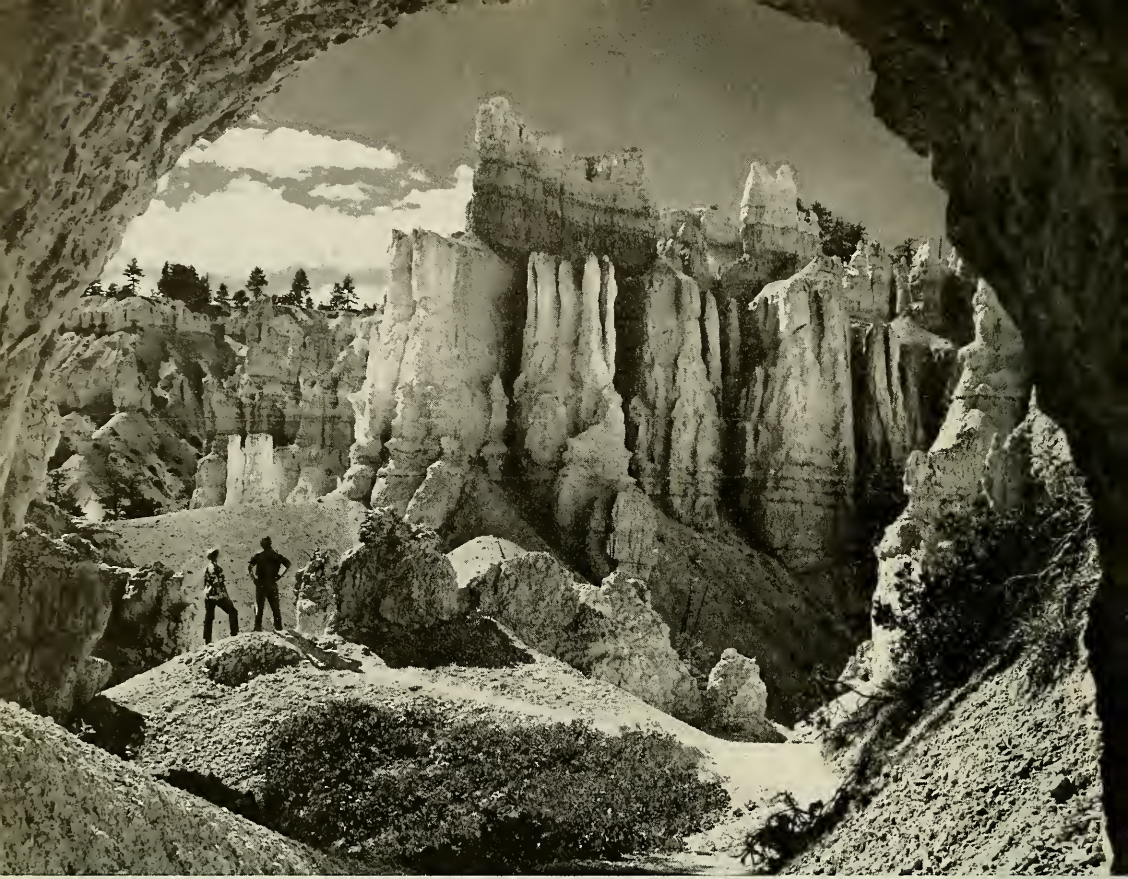
I would much like to know who told these little devils that Santa Claus had moved into that section of the Colorado Desert and was making daily visits to dip burrows within easy walking distance of his camp.

Obviously the news did get around. Or at least I can think of no other reasonable explanation for this sudden migration to our area.

The "punks" were, of course, in part responsible for that increase in dip population. This is the rather silly name we gave to those tiny dips who appear each autumn as amazing, diminutive replicas of their parents, even to that extra-long tail. The punks live in miniature burrows of their own fashioning and quickly learn to eat from your hand. By springtime they are suddenly full grown.

At the present rate, I hope within another year to corner the dip market in my section of the Colorado Desert. It will take a lot of bread crusts and carrots, but I hope to see them come.





▲ **Tunnel Vista.** So extraordinary is the scenery in Bryce Canyon that the visitor can imagine he is exploring another planet. He may feel dwarfed in the presence of these splendid formations, towering above him in beautiful balance

Beautiful Bryce

A gigantic gallery of red stone goblins, considered by many to be the supreme masterpiece of its kind

By Harold E. Vokes *with photographs by* Josef Muench
Department of Geology
Johns Hopkins University

"A HELL of a place to lose a cow!" Such was Ebenezer Bryce's characterization of the famous scenic area in southwestern Utah that now bears his name. Having long lived in the land where "big cliffs and canyons are everywhere," he apparently was not greatly impressed by the weird erosional features and colors that were to make his canyon, now Bryce Canyon National Park, a mecca for many thousands of tourists each year.

To the Paiute Indians it was *Unka-timpe-wa-wince-pock-ich,* a term that has been translated to read "Red rocks standing like men in a bowl-shaped recess." According to their legend:

"Before there were any Indians, the *To-whon-an-ung-wa* lived in that place. There were many of

TOWER BRIDGE: a giant span guarded by tall ylons conical in shape. This is on the Campbell anyon Trail in Bryce Canyon National Park

▲ A HORSEBACK PARTY enjoying the excellent trails that lead among the marvelously eroded gorges and bastions of Bryce Canyon

▼ THE FLUTED FIGURES and fantastic erosional forms in this section of Bryce Canyon National Park have earned it the name of Fairyland

THE VISITOR stands in awe
nid the gigantic towers and
nyons of this "lunar land-
ape," which, prosaically, has
en given the name of Wall
reet at this point

➤ FORMATIONS IN THE QUEEN'S GARDEN. The delicacy of the carving and the tinting of the walls give them an ethereal look despite their great size

them. They were of many kinds—birds, animals, lizards, and such things—but they looked like people. They were not people; but they had the power to make themselves look that way. For some reason the people in that place were bad; they did something that was not good. Because they were bad, Shin-awav [a Paiute demigod of great power] turned them all into rocks. You can see them in that place now, all turned into rocks; some standing in rows, some sitting down, some holding on to others. You can see their faces, with paint on them just as they were before they became rocks."*

Sculptured and carved by the headwaters of the many small, intermittently flowing tributaries that enter the Paria River from the west, the Bryce Canyon National Park is essentially a wide horseshoe-shaped amphitheater whose seating tiers are the massive strata of the formation known as the Straight Cliffs Sandstone. Above this, the *To-whon-an-ung-wa* occupants of the amphitheater are the erosional remnants of the red, pink, white, and varicolored limestones and calcareous sandstones of the Wasatch formation.

The Straight Cliffs Sandstone, with its massive buff and tan sandstone layers, is composed of the sands and occasional mud beds laid down along the margins of a tongue of the last seaway to penetrate this southwestern part of Utah. Fossils of marine, brackish, and even of fresh-water species of clams and snails attest to the fact that these deposits represent almost the beach sands of that sea. No fossils of vertebrate animals have been found in this immediate vicinity, but rocks of similar age from surrounding areas bear witness to the fact that the shores of this sea were the haunts of the dinosaurs who were then in the last millennia of their domination of the earth. It is in the southern part of the Bryce Park area, though apparently not in Bryce Canyon itself, that these forms are found. There the Straight Cliffs Sandstone is overlain by a series of softer sandstones, gray and green-gray in color. These have yielded fragments of duck-billed and carnivorous dinosaurs, associated with fresh-water clams and snails and fossil leaves.

In the upper part of the cliffs and slopes in the Park, the limestones and limey sandstones contain fossils of fresh-water clams and snails. Clearly, therefore, these rocks were deposited in small streams and transient lakes in a low, valley-like region. Iron oxide is abundantly disseminated throughout all of the beds here. This gives the fresh surfaces of the rocks a pale pink to light red color, but much more intense tones develop when the rock undergoes further oxidation through weathering.

Scattered through some layers are small grains of black manganese dioxide. These are readily disintegrated by water and upon weathering mix with the iron oxides to give various lavender tones to some of the rocks. Red and pink tones are, however, so dominantly the colors of Bryce Canyon that one has to search for the lavenders, which have become lost in a pink wilderness.

The fossils found in the Wasatch formation throughout Utah include primitive types of mammals, among them the earliest ancestors of the

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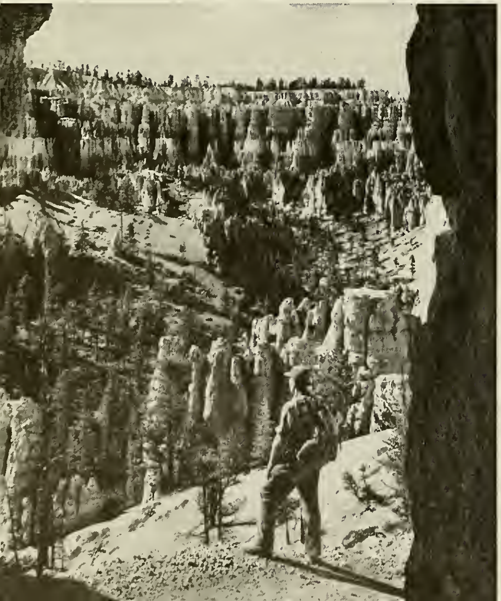
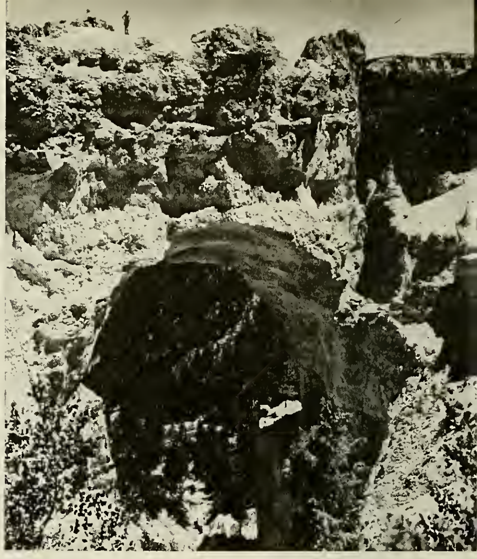
* Quoted by H. E. Gregory: U. S. Geol. Surv., Professional Paper 226, p. 17.

∧ It is the depth and narrowness of this chasm that reminded those who named it of the Canyons of New York City and led them to call it Wall Street

∨ Bryce Amphitheater: a breath-taking view framed by two flanking walls of rock. The myriad figures are shaped and colored to fit almost any fancy





∧ Bryce Natural Bridge: A remarkable erosiona remnant produced by the action of rain, snow, fros and other atmospheric agencies. When the sun strike the arch, it sometimes takes on the translucence c human flesh

∨ The Comanche Trail takes the visitor into th heart of the wonderland of the Pink Cliff Formatio where strange figures flaunt their eroded finery on a sides

▲ **Oastler Castle** reveals the sky through a great window, cut beneath elaborate spires and turrets

horses. There is evidence that a considerable interval of time elapsed here bètween the formation of the rocks representing the Age of Reptiles and those ushering in the Age of Mammals. The uppermost dinosaur-bearing sands were eroded from this region before the Wasatch strata began to be deposited. In the basal part of the Wasatch, there are beds and lenses of gravel among whose pebbles are fragments of these older strata.

During the millions of years that have passed since the time when the Wasatch formation was deposited, southwestern Utah has been lifted far above sea level. The tops of some of the cliffs now have an elevation of as much as 9000 feet. Some of the larger streams have cut deep valleys into this surface and by so doing have outlined, in the interstream areas, great plateaus margined by steep cliffs. As the tributaries of the rivers eat their valleys back into the cliff faces, they also carve out the marvelous scenic effects that make this area so striking.

Nature's sculpturing in Bryce Canyon is influenced by many variable factors, among which the most important are: the amount of rainfall available to the streams, the steepness of the slopes on which the rain falls and over which the water runs off, and the resistance of the various types of rocks to the action of water. Thus, the rather hard, thick beds of the Straight Cliffs Sandstone tend to form steep cliffs. Softer and more soluble limestones like the Wasatch formation might have been expected to erode back into gentler slopes, but not so. The steepness of the surface of the Straight Cliffs and the tendency for the rains to come at widely scattered intervals but in heavy downpours has resulted in deep erosion along any and all cracks and crevices, with the rocks between remaining little worn. Standing as grotesque, isolated pillars, the remains of the *To-whon-an-ung-wa* people are separated from one another by small canyons down which the rain waters pour during every storm. Thus a fortunate combination of rock types, chemical coloring matter, favorable topography, and climate give us, within easy access of so many motorists each year, a most unusual natural wonder—a wilderness of red pinnacles that is considered by many to be the supreme masterpiece of its type.

Undergroun

Exploration into the family life of one of our most interesting owls called for special techniques of observation and answered the question, "When is a rattlesnake not a rattlesnake?"

By Lewis Wayne Walker

All photos by the author

By some standards of comparison, burrowing owls may not be the most unusual members of their family, but their choice of cellarette homes beneath the surface of the ground and their daylight activities seem to set them apart as true individualists.

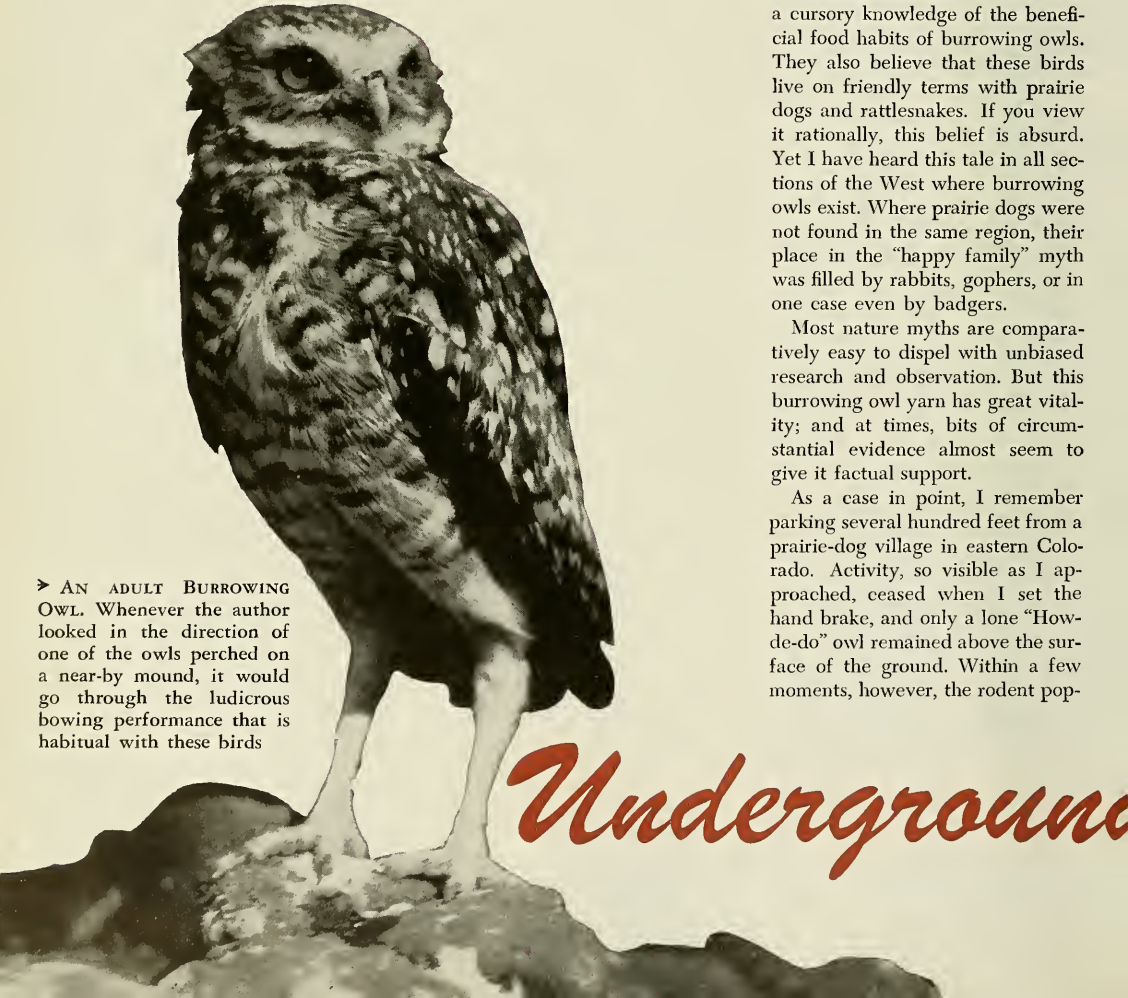
Across wide and varied areas, from deserts below sea level to the rolling plains of mile-high Denver, they are known by a dozen different names. And each of these names tends to give a touch of personality to the birds. The "How-de-do" owl of the cattle country or the "Billy" owl of the farmlands shows that all people consider them extra-special birds.

Burrowing owls are generally liked. They are about the only members of their large clan that can perch on fence posts, haystacks, or rocks within easy range of most farmhouses without becoming lifeless targets before the day is over. Even so, their numbers have decreased alarmingly, and now they have become depressingly rare. The blame rests chiefly on those sportsmen that carry a loaded gun next to the driver's seat—people who never bothered to hunt for the burrows and see the multitude of grasshoppers, cicadas, and other noxious insects that pave the runways leading to the nests below.

Most ranchers and farmers have a cursory knowledge of the beneficial food habits of burrowing owls. They also believe that these birds live on friendly terms with prairie dogs and rattlesnakes. If you view it rationally, this belief is absurd. Yet I have heard this tale in all sections of the West where burrowing owls exist. Where prairie dogs were not found in the same region, their place in the "happy family" myth was filled by rabbits, gophers, or in one case even by badgers.

Most nature myths are comparatively easy to dispel with unbiased research and observation. But this burrowing owl yarn has great vitality; and at times, bits of circumstantial evidence almost seem to give it factual support.

As a case in point, I remember parking several hundred feet from a prairie-dog village in eastern Colorado. Activity, so visible as I approached, ceased when I set the hand brake, and only a lone "How-de-do" owl remained above the surface of the ground. Within a few moments, however, the rodent pop-



➤ An adult Burrowing Owl. Whenever the author looked in the direction of one of the owls perched on a near-by mound, it would go through the ludicrous bowing performance that is habitual with these birds ulation commenced to emerge from the closely-packed burrows, and in ten minutes the animals were foraging for grasses many yards from their individual homes.

Then came sudden panic as the creatures scampered for cover. Each twitch of a tail brought a bark, or each bark brought a twitch of a tail. I have never been able to decide which comes before which, for it almost seems that the vocal cord is invisibly knotted to the rear appendage. The lone owl and several prairie dogs fought for the chance to scramble into the same burrow together, as an eagle swooped low over the now-barren village. Heads appeared almost instantly, and then dogs in all parts of the colony scampered away from emergency havens sought in the face of danger and ran for their own individual burrows. But in this moment of village-wide fright, I had seen one part of the myth seemingly verified: dogs and owl within the same hole!

And then from another section of the same state comes the Platteville series of Prairie rattlesnakes—almost 300 specimens caught in 3 days within a quarter-mile radius in the heart of an occupied prairie-dog town. C. B. Perkins, collecting for the San Diego Zoological Society, pinioned some of these to the ground between burrows, but he hooked most of them—sometimes four or five at a time—from actual burrow entrances as the snakes emerged from hibernation. A short time before the reptile collector disturbed the village, there had been prairie dogs on many of the mounds; and soon after the humans left, the rodents came to the surface again.

Other cases offering irrefutable evidence that prairie dogs and snakes do utilize the same holes *in an emergency or at separate times* were brought to light, but there was no evidence to support the myth that burrowing owls, prairie dogs, and rattlesnakes live as a "happy family." It was not going to be easy to refute the myth. Observations had to be made in the wild, not on the surface of the ground, where the presence of a human could alter dispositions, but underground where the "happy family" relationship was supposed to exist.

For the next few days, nesting owls of the region had to cope with a new and invulnerable enemy as I proceeded from burrow to burrow and probed a long wire into the darkened tunnels. I had plans for a new type of photographic observation, but I needed a burrow with a reasonably straight entrance—one in which I could accurately measure the depth and distance to the nesting chamber beneath.

Most of the tunnels turned sideways. Some rose; a few dropped and doubled back in contortions that completely baffled my probing wire. And then luck preceded despair. Two feet below the ground level and four feet in, the wire trembled violently. By turning it slowly I could feel it scrape the hard shells of eggs beneath an incubating owl—an owl that was vainly trying to fight the wire away.

For an hour or so I calculated the depth of the nest from the angle and length of the wire protruding. Then, to be sure, I recalculated it all again, for I had learned that tunnels ideal for my purpose were the exception and not the rule.

About a foot behind the spot where the chamber was presumed to be, I carefully dug straight down. After removing two cubic feet of earth, I tunneled horizontally toward the nesting chamber. I knew the success of my study would hinge largely on this excavation. And when I hit the nesting chamber at floor level, I was probably more elated than the Hudson tunnel engineers when their two test runs touched beneath the river. After placing a tin temporarily above the eggs to prevent damage from cave-in, I removed the entire roof of the nest and replaced it with a pane of glass. This permitted the entrance of sunlight for about an hour at high noon.

All during this work, the "How-de-do" owls went through their ludicrous performance, bowing repeatedly from near-by prominences. If my glance was not obviously pointed in their direction, they would stand sedately without much show of motion. But they were quick to realize when they were the object of my fixed gaze. They would then rise to their fullest height, bow suddenly two or three times, touching breasts to the ground, and nervously fly to other knolls, giving voice to their chattering cries.

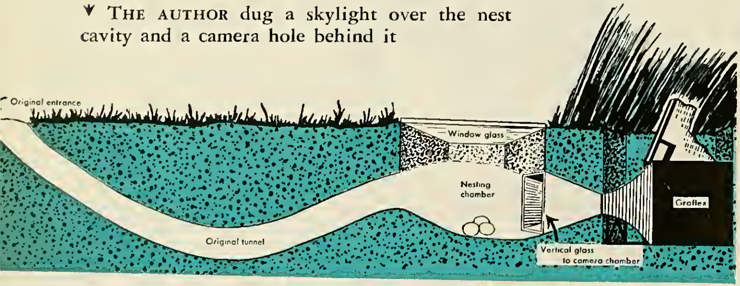
Some of these far-flung perches were the mud caps of occupied prairie-dog burrows; and when the birds landed on these, I received my first indication that prairie dogs could be intolerant. A few actually ran to their burrows and shouldered the trespassing birds into flight.

After a wait of several days I returned to the nest, wondering whether the owls had continued their housekeeping in the face of my intrusion. Both were near the nest opening; but although I waited and watched from a distance, they failed to go underground. Before leaving, however, I lifted the glass and felt the eggs in the chamber below. They were warm, showing that one of the birds had recently been incubating. The next day at dawn the camera was placed in position, and then the waiting really started. It was a test of endurance. At times, while lying under the canvas and

with Burrowing Owls

▲ A young Burrowing Owl of flying age, none the worse for its "fish-bowl" infancy

▼ The author dug a skylight over the nest cavity and a camera hole behind it



staring into the ground glass, I was about to concede that the owls would win.

The first view of the old bird in the chamber was a distinct surprise. I had been flat on the ground for hours and thought that I knew just where on the surrounding terrain each adult was perched. As I glanced into the Graflex, however, imagine my amazement to see an adult standing over the eggs and glaring into the camera lens. Very slowly I reached down and pushed the release. The noise was too much for the bird's nerves. It jumped straight into the air and tried to fly through the glass above! When the reflex mirror was pulled down again so I could see through the lens, the parent had disappeared, and I thought at the time that the bird had gone out of the tunnel. In this, however, I was pleasantly mistaken. Within five or six minutes, a head appeared, and yellow eyes glanced about the nesting chamber. I took another picture, but it frightened the bird into the darkness once more.

A week or so later, I was back again. Both birds had become accustomed to the man-made changes, and aside from viewing the uncovered glass above with alarm, their home life was probably normal. If

one of the pair was incubating, its mate would come to the entrance of the burrow and call whenever it captured some dainty morsel that it wished to share. The one below would then get off the eggs and go to the surface through the tunnel; but on several occasions it viewed the glass above as though meditating a short cut. The faintest movement of my hand toward the camera trigger brought about a beak snapping and a ruffling of feathers in an attempt to drive me away. It was after the young had hatched, however, that the heroic actions really started.

When I looked through the camera and saw several downy white chicks next to the remaining eggs, the parent bird crouched above them, weaving from side to side and doing everything to make a small body look really ferocious. At the click of the camera the adult charged, and leaning against the glass partition that separated the camera from the nest chamber, beat upon it with rounded wings. For the next hour or so the bird was so quick to attack at the slightest movement of my hand that I took no more photographs. Then the sun cast a shadow on the nest, and I retired.

Several weeks later I visited the nest again. The young had grown considerably and were spending much of their time running about the chamber and tunnel. One lone egg of the clutch was infertile, and the fledglings used it as a practice target to improve their footwork. From almost any spot in the chamber they could stab out with their absurdly long legs and grasp the white object. Sometimes they would reach down with their beaks as though they were plucking off imaginary grasshopper legs, but as a rule they were satisfied to use it solely as a target.

At about this stage in the development of the young, I noticed that some of the insect food was brought home still full of life. Beetles had their abdomens crushed and the grasshoppers their jumping legs removed, but both were still able to cover ground at a slow crawl. I had not noticed this practice of bringing live prey before there were any chicks in the nest, and I wonder whether it may not have served a purpose in helping the young to learn to catch their own food.

In a period of an hour and forty minutes the young were supplied with the following items: 22 grasshoppers, 17 beetles, 2 lizards, a frog, and a jumping mouse. Another catch for about an hour included a small garter snake (these are water-loving reptiles, and the nearest water was over three-quarters of a mile away) and one striped spermophile, as well as the usual number of grasshoppers and beetles.

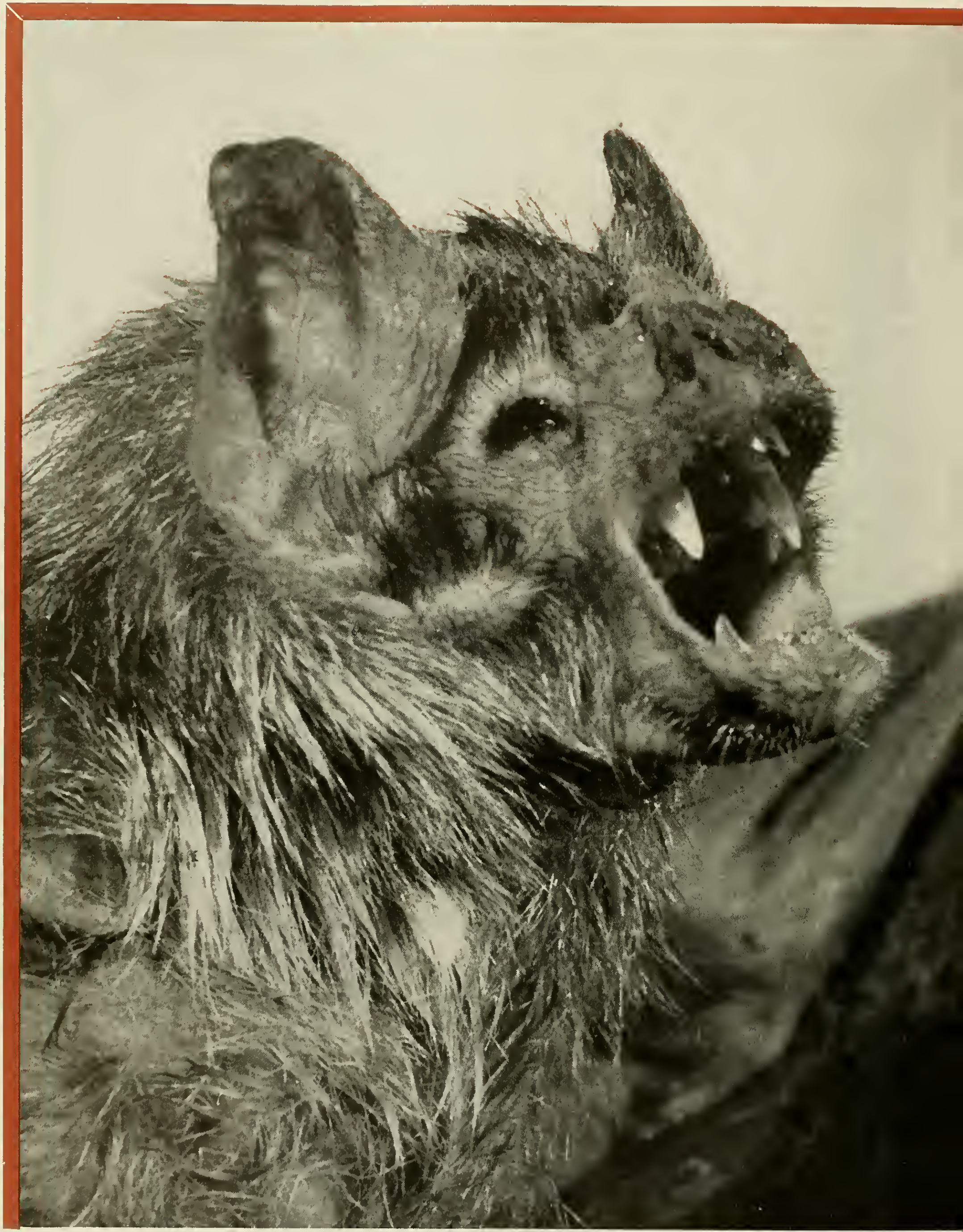
Then I got a surprise. That day I noticed that the glass separating the camera from the nest had become dusty, and while the adults were foraging for food, I decided to clean it thoroughly. As soon as I reached toward it there came from the chamber a noise that so closely resembled a mess of rattlesnakes that I jerked my hand back. The chamber, however, was empty, with no sign of a reptile of any type. But from the darkness of the tunnel I could see the heads of some owlets, and it was from that direction that the sound issued.

The rattle came from a bird whose throat was vibrating rapidly. Each time the throat stopped pulsating, the clear-cut noise of a rattler would stop. The yarn of the "happy family" came to mind. Might not this sound very largely explain it? Rancher friends, normally not given to exaggeration, had told me time after time of hearing rattlesnakes immediately after scaring young owls into a burrow. This had been related so often that I was glad to find that it was actually

Continued on page 95

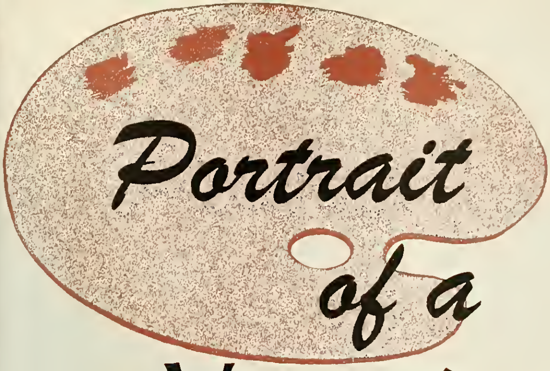
◄ ONE OF THE ADULT OWLS on the eggs, as seen through the glass dividing the camera from the underground nest

▼ ADULT AND TWO YOUNG in the nest. The remaining egg did not hatch



Courtesy of Dr. Harald N. Johnson, The Rockefeller F

▲ SCARCELY A LOVELY CREATURE at best, the vampire bat now adds the danger of fatal infection to the habit of piercing the skin of sleeping victims and feeding upon their blood



Portrait of a Vampire

Discovery that the vampire bat carries rabies makes its activities shocking beyond anything usually found in nature's arena

By Joseph Bernstein

TRINIDAD lies but a short distance from the mainland of South America, directly north of Venezuela. In the southwestern part of this British Crown Colony is the village of Siparia, and there, in the summer of 1929, a native fell ill with paralysis and eventually died. Within three months there were a dozen other cases, and the following year, four more. All ended fatally.

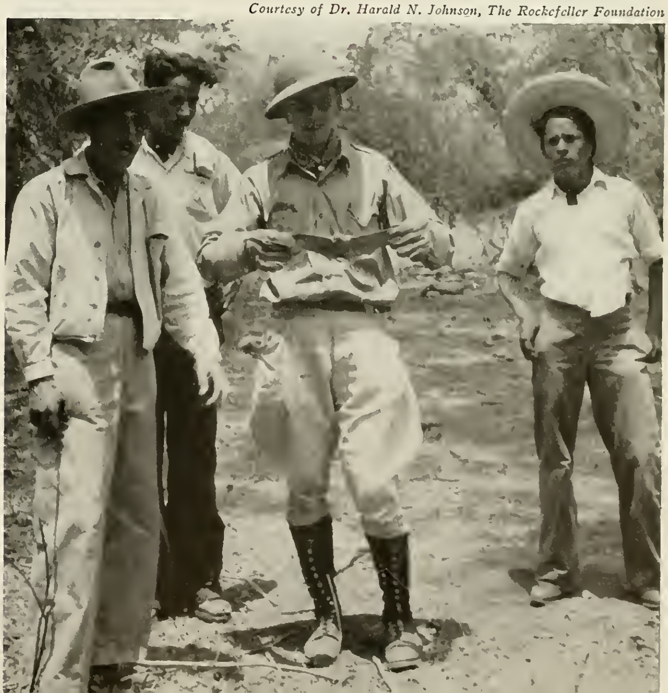
The symptoms were most unusual and had never been seen before by any physician on the island. There was first a sensation of burning and tingling in the foot and leg, which soon became completely paralyzed. Fever and headache developed, and the paralysis spread to the other leg, the trunk, and finally to the muscles of swallowing and breathing. The Government Bacteriologist, Dr. J. L. Pawan, thinking that the disease might be a severe form of poliomyelitis, injected an emulsion of the first victim's spinal cord into the brains of four monkeys. The results were flabbergasting.

In a few days three of the animals were found clinging to the bars of the cages uttering peculiarly piercing shrieks – cries they had been unknown to utter in the memory of investigators with many years of experience with these animals. They appeared to be in a state of abject terror, one of them staring rigidly into space, ignoring food and observers, and squealing continually. Cultures were then made from the brains of these animals, and other monkeys were inoculated. The behavior of the newly inoculated animals was even more alarming and violent. One of them killed its cage-mate and later developed powerful muscular spasms; two of them chewed off their own fingers, and one the entire skin of its forearm. The symptoms now had a familiar pattern. The animals were in the throes of rabies.

Confirmation of this rather startling observation came from two sources. When Dr. Pawan examined the brains of the monkeys under the microscope, he saw the tiny round structures in the nerve cells—the Negri bodies—which are conclusive evidence of rabies infection. Also, when brain tissue from one of the humans dying in 1930 was examined by the Rockefeller Institute and the Lister Institute in London, both laboratories isolated rabies virus.

Now, all this was most remark-

Courtesy of Dr. Harald N. Johnson, The Rockefeller Foundation



➤ **Dr. Harald N. Johnson** displaying a vampire bat that his party has captured

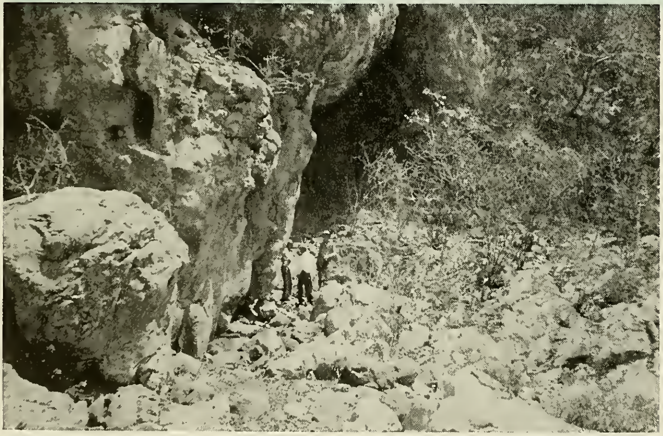
Courtesy of Arthur M. Greenhall, General Curator, Detroit Zoo

▲ **Dr. Arthur M. Greenhall** demonstrating the wingspread of a vampire bat. Notice the leather gloves. No investigator would think of handling this animal without such protection

▲ **Deep scars** that might have been fatal to human flesh mark the gloves. The leather later became so chewed up by vampire bites that it literally disintegrated

▼ **Dr. Harald N. Johnson** and his colleagues in front of the "Cave of the Monkeys" in their quest for rabid vampire bats. This cave, near Aguililla, Michoacan, Mexico, contained primitive implements, iguanas, and a puma den

Courtesy of Dr. Harald N. Johnson, The Rockefeller Foundation



able indeed. Since 1914 there had not been a single case of rabies on the island, where the most rigid quarantine laws were strictly enforced. It is impossible for a dog to be brought into Trinidad without a six-month quarantine, and even then the Government Veterinary Surgeon must certify that the animal is free from rabies. Where, then, had the natives acquired this dread disease?

At that time the livestock in Trinidad were succumbing in large numbers from a peculiar ailment which had been diagnosed as botulism. The symptoms of this disorder, which first appeared on the island in 1925, were constipation, grinding of the teeth, drooling, loss of muscular co-ordination, and finally inability to breathe—which brought on death. The strange thing was that the East Indians who lavished affectionate care on the beasts and came constantly in intimate contact with them never contracted the disease. Yet Dr. Pawan was able to isolate rabies virus from the brain of an infected cow and saw the telltale Negri bodies in the brain tissue of another animal.

This clue led Dr. Pawan to study a remarkable series of events that had begun early in this century in the State of Santa Catarina, in southern Brazil. Along a thin stretch of land between the sea and the mountains, a severe outbreak of rabies had occurred among cattle and horses. In 1908 alone, the disease wiped out about 4000 head of cattle and about 1000 horses. A rigorous quarantine on dogs was then clamped down, since they are the traditional vectors of rabies, and some of them were known to be diseased. In six months of 1912, about 7000 dogs were destroyed in the affected area—without the slightest effect on the spread of the disease. Peculiarly enough, a swiftly flowing river, which no dog could possibly cross, was not a barrier to the infection. And what seemed most confounding to the observers, most of the deaths took place in heavily wooded areas were dogs were practically nonexistent.

At that time the people in the area were witnessing a phenomenon that neither they nor their forebears had ever seen or heard of and which struck cold terror in their hearts. Bats are very common in South America and are traditionally children of the night, never emerging in the daytime. Yet at that time bats were seen flying frenziedly about in broad daylight, fighting with each other, shrieking, and biting livestock. The bitten animals later developed rabies. One day a vampire bat was captured in the actual act of feeding on the blood of cattle during the daytime. It was killed, and its brain was examined. Both rabies virus and Negri bodies were found, and there could no longer be any question as to what was killing the Brazilian livestock. Vampire bats were transmitting rabies virus to the animals they attacked.

Now, the vampire bat is so common in Trinidad that the natives scarcely pay it heed. But at the time of the outbreak, they too saw the astonishing sight of bats flying in broad sunshine, trying to bite humans and animals, and crashing crazily into the walls of buildings.

One hot July night in 1931, an East Indian housewife felt something "sting" her while she slept. She awoke and shouted to her husband, who lit a lamp. The light showed blood about her feet, and just then a bat flew from the foot of the bed. Two days later she was admitted to the hospital, where examination revealed a tiny elliptical wound on the second toe of the left foot. It was not long before the woman complained that her foot "felt dead" and that she could not bend it at the ankle. The leg gradually became paralyzed and lost all sensation. Her temperature rose, and finally she found it difficult to breathe or swallow. At last she lapsed into a coma and died. A monkey injected with an emulsion of her brain promptly developed all the symptoms of rabies.

The natives of Trinidad are so familiar with the unpleasant habits of the vampire bats that they take special precautions against them before retiring for the night. The houses of the poorer people have a space between the eaves and the walls to permit adequate ventilation, and this opening is packed with branches to prevent bats from entering. Windows are tightly shut, and the native may even allow himself the luxury of a night light—a wick burning in a cup of coconut oil. But here, as elsewhere in tropical America, many windows and doors cannot be closed; and up to 1936, 53 people died in Trinidad of rabies transmitted by the bites of bats.

One day in August, 1933, a man who resided at Pointe-à-Pierre brought a vampire bat to Dr. Pawan. His houseboy had been bitten on the foot by the creature, which insisted on remaining in the house, flying around from room to room. It showed no fear of the people present and, as a matter of fact, was very pugnacious. "During my attempts to drive it out," reported the man, "it flew straight at both me and my wife, thereafter settling on the wall about ten feet from the floor. When my wife passed under it, it again flew directly at her with its mouth wide open." While it hung on the wall, it kept its mouth agape, turning its head from side to side.

Dr. Pawan lost no time in killing the vampire and injecting a bit of its brain into a rabbit, which later became paralyzed and died. The houseboy was given a series of anti-rabies vaccine injections and did not contract the disease.

The origin of the expression "vampire" is steeped in mystery, but it is of Slavonic derivation. It apparently arose not in connection with bats but with early East European legends about the souls of dead people who had the disagreeable custom of leaving their graves at night in order to suck the blood of sleeping victims. Dr. Arthur M. Greenhall, General Curator at the Detroit Zoo, who has delved rather thoroughly into vampire mythology, has not found any references in the early legends to a vampire assuming the form of a bat. Nor is that strange, for the vampire bat has never existed in Europe at all, being found only in South America, Mexico, and Central America. The Mayans also had legends about blood-sucking creatures, but these were unquestionably based on actual experience. Cortez' followers came in contact with vampire bats, and when they returned with their tales of "blood-sucking" bats, not only were the vampire legends strengthened, but the stories were now more and more associated with bat-shaped creatures. The legend finally reached its definitive form with Bram Stoker's story of the horrendous exploits of Dracula.

Columbus himself received reports of bat bites on Trinidad when he discovered the island in 1498. There is some evidence that the first horses to be brought to South America were wiped out by the depredations of vampires. Colonists and missionaries that arrived later brought over horses and cattle from Europe, but these also did not fare too well. There is an account by an eighteenth-century writer that describes how these animals were exterminated by bats in Ecuador and other parts of South America. Also, the early records of Trinidad indicate that strenuous attempts to establish livestock farms near the villages of Erin and Siparia were unsuccessful because of the "ravages of bats."

The vampire was first classified as a separate genus over a century ago. The northern vampire, *Desmodus rotundus murinus,* and the southern vampire, *Desmodus rotundus rotundus,* are the species with whose exploits in blood-letting we shall be concerned here. The scientist who first actually witnessed the vampire bat drawing blood from an animal was Charles Darwin himself, but the first systematic account of this animal's blood-eating habits and its attacks on humans was given in 1910 by a French physician, Dr. A. Guillon, who was stationed in French Guiana. This doctor reported that patients at the leprosarium and convicts from the penal colony stationed in a forest were often bitten by vampire bats while asleep.

Trinidad has a rich assortment of bat life—29 genera and 34 species—but most of them are insect and fruit eaters, with a few fond of dining on fish, meat, or the nectar of flowers. These bats are quite content to stay away from humans and, contrary to persistent popular belief, do not get entangled in human hair. Only one species, the vampire bat, feeds on blood and nothing else. The vampire has a wingspread

Courtesy of Dr. Harald N. Johnson, The Rockefeller Foundation

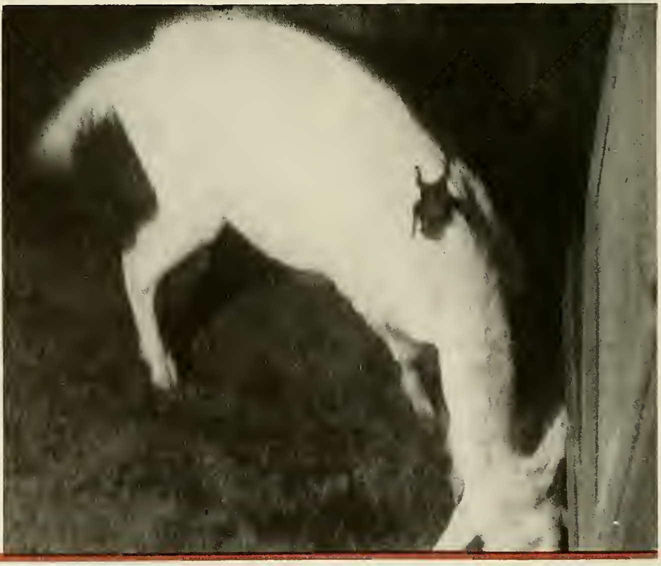
▲ LOOKING at this pleasant, peaceful scene, it is difficult to believe that the photograph was taken in the heart of the vampire bat territory in Mexico. Large numbers of livestock are being destroyed here by rabies transmitted through the bites of vampires

▼ A POOL OF EXCREMENT at the opening of a cave in Mexico. With its strong ammoniacal smell, this pool is the telltale evidence of the existence of a colony of vampire bats in the cave

Courtesy of Dr. Harald N. Johnson, The Rockefeller Foundation

▼ VAMPIRE caught in the actual act of biting a goat

Courtesy of Arthur M. Greenhall, General Curator, Detroit Zoo



of about thirteen inches and is about the same size as its insect-eating relatives, the body being about four inches in length. The teeth are uniquely specialized for biting, the incisors being extremely sharp, with razor-like edges. With these it can swiftly scoop out a small crater-like wound. The lower incisors have a wide space between them, and the long canine teeth act as supports for the gouging upper jaw.

The vampire bat is unusual in still another respect. It has enormously large padded thumbs, which are used as forefeet. When a vampire is stalking, it folds its wings together tightly in umbrella-style, resembling a four-legged animal, and it runs swiftly and silently on its thumbs and hind legs. Many other bats have a leaflike structure on their noses, but the vampire lacks this. In color it is gray or reddish-brown on the back, the underside being light brown.

The digestive tract is well adapted for the digestion and absorption of blood, for it consists of a very narrow tube from the mouth to the rectum. Thomas Huxley, who studied the vampire's intestine-like stomach in 1865, declared it ideal for the speedy assimilation of the digested blood. Shortly after the bat starts to feed, it begins to urinate and continues to do so throughout the feeding. This process permits the rapid—almost immediate – elimination of liquids, while the digestive tract holds only the solids of the blood for further digestion.

In 1933, the late Dr. Raymond L. Ditmars, Curator of Mammals and Reptiles at the Bronx Zoo, and Dr. Arthur M. Greenhall brought back a vampire bat they had captured in Panama. During the voyage, they kept the animal alive by feeding it defibrinated blood served in a flat dish. For a long time they did not see the vampire feed. It would merely hang head downward from the top of its cage while the dish was placed inside—but the next morning the dish would be practically drained of its contents. Ditmars and Greenhall thereupon set up a nightly vigil, and finally the bat became tame enough to display a lively interest when the dish was brought around.

"Finally," reported the scientists, "there came a night when the bat descended the side of the cage with her usual deliberation. Reaching the bottom, she started across the floor with wings so compactly held that they looked like the slender forelimbs of a four-footed animal. Her rear limbs were directed downward. In this way her body was reared a full two inches from the floor. She looked like a big spider, and her slow gait increased that effect." The approach to the dish was typical of the way the bat would explore the body of a sleeping victim for an appropriate place to start the flow of blood.

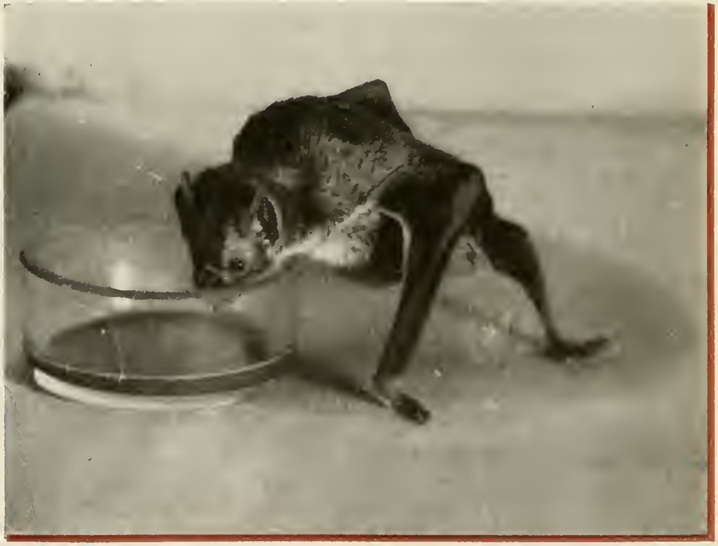
At last the bat bent over the dish and ejected her long pink tongue. At no time were her lips near the dish. The tongue began darting swiftly into the blood and was soon working with such piston-like precision that a pulsating ribbon of blood poured in an unbroken stream into the creature's mouth. She did not suck the blood. Sated at last, and with abdomen swollen to a sphere, she backed away and leaped into the air with wings spread. She reached her position at the top of the cage, where she hung head down. "Gorged and inverted," stated Ditmars and Greenhall, "she preened herself like a cat."

Because of the myths about vampires, there has long been a belief that the vampire bat *sucks* blood. This conception was first shown to be without foundation by Dr. L. H. Dunn, who wrote in 1932: "The vampire does not suck blood, as popularly believed, but takes it up with its tongue, seldom placing its mouth on the wound." Still another superstition, entirely without basis in fact, has it that vampire bats hover over their victims, lulling them into unsuspecting slumber by gently fanning them with their wings. Actually, when attacking livestock, the vampire may sail back and forth over the victim a few times; then it strides back and forth on the animal's back, looking for a choice spot in which to sink its in-

Continued on page 92

▼ A VAMPIRE BAT taking blood from a glass container. Contrary to popular belief, the vampire does not actually suck the blood. A lapping motion brings a ribbon of the liquid to the bat's mouth

New York Zoological Society photo



A statement from the U. S. Forest Service
and some editorial comments on an important public issue

CUT or Let Grow?

In this age of deficit spending and synthetic substitutes, should we adopt a speed-up policy of chop, saw, and be wealthy? Or should we cherish some of our National Forests for their aesthetic value and their worth to future generations?

IN a recent book review in NATURAL HISTORY (Oct., 1951), Dr. Willard G. Van Name stated that the magnificent stands of timber that once existed in our National Forests have been entirely made away with. The Chief of the U. S. Forest Service, Lyle F. Watts, denied this in a 700-word letter, which we published in the December issue of NATURAL HISTORY.

Ordinarily we do not feel that our Book Review Section is a fit arena for the opening rounds of a public debate. Rather, it is a place where independent reviewers offer independent opinions, which are intended to be taken as such. In this instance, however, we published the letter of protest because we felt that an important public issue was involved.

Readers will recall that we also asked the writer of the protest for further information regarding the specific areas in the National Forest for whose protection the Forest Service seeks public support. We felt that those of our readers who are interested in the preservation of some of our last remaining stands of virgin forest would prefer to know exactly what areas are so designated by the Forest Service, than to have them discussed in general terms.

Many Americans apparently have the idea that *all* the National Forests are protected from cutting as are the forests in the National Parks. They are not. The selling of wood "on the stump" is one of the authorized activities of the U. S. Forest Service.

The wood in these forests does not belong to an individual or a company or a government bureau. It belongs to the citizens of the United States. Anyone is therefore entitled to his own opinion as to whether the Forest Service is selling the timber too fast or not fast enough.

The U. S. Forest Service is entrusted to carry on a number of activities besides selling timber, such as forestry research, watershed protection, fire control, wilderness preservation, and the sale of grazing privileges on these public lands. However, the Forest Service is definitely in the lumber business. It makes 25,000 separate sales of timber in National Forests each year. Last year they totaled four billion board feet.

Dr. Van Name, who has long identified himself with conservation causes, said something else in his book review that drew fire from the Forest Service. He expressed the opinion that the Forest Service, which alone can safeguard the publicly owned forests, has put an end to any hope that a future timber famine can be avoided.

Readers will recall that the Forest Service, in denying Dr. Van Name's assertions, stated that 44 million acres (which is less than 3 percent of our land area) remains in virgin timber. The Forest Service also stated that on 14 million acres of "Wilderness" (less than 1 percent of our land area), no timber cutting is allowed.

In the same letter, the Chief of the Forest Service acknowledged that throughout the United States the cutting of saw timber—our most valuable type of timber—is about 50 percent greater than growth, according to the most recent surveys.

Which, then, are the forests the Forest Service is committed not to cut? That is what we asked to see —"the six finest forests for whose protection the Forest Service needs continued public support."

The reply, from Dana Parkinson, Chief of the Division of Information and Education in the U. S. Forest Service, is published below. In reading it, we welcome the reader's help in locating the forests the Forest Service wants to preserve.

* * *

"THANK you very much for your letter of November 19. We appreciate your printing our letter regarding Mr. Van Name's review of the book *Forests and Men*, . . .

"In your letter you asked for information and pictures of the six finest forests under Forest Service jurisdiction. To pick out the six finest forests is almost impossible. National Forests were created from the public domain or developed through purchase for two major rea-

U. S. Forest Service photos

▲ **Kootenai National Forest,** Montana. Most of the lands in this Forest are used for timber production. Almost 64 million board feet were cut in 1951

▲ **Coconino National Forest,** Arizona. Thirty-five percent of the volume of the virgin stands are being cut. Over 85 million board feet were cut in 1951

sons: to conserve the timber resource and to protect the watersheds of navigable rivers.

"The lands were in various conditions when we took them over—some heavily forested, some burned over, some cut over. Some were valuable; some were badly depleted. Under our system of administration the Forests are used for the activity or combination of activities for which they are best fitted: recreation, wildlife, grazing, timber cutting and growing, or watershed protection. These uses are integrated for the best interests of the majority of people.

"We realize that you are primarily interested in the timbered forests. Rather than pick those which have the biggest and most timber, and which many would call the finest, we have selected five representative National Forests in which management of the timber resource is of major importance.

"Aims of the Forest Service in managing its timber resource are: to provide for orderly cutting of National Forest timber, to leave immature trees for further growth and future cutting, to supply wood-using industries with raw material, thereby stabilizing the economy of communities dependent upon timber industries, and to encourage new industries where the timber resource warrants it.

"The Forest Service does not cut timber, however, where it will harm the other forest uses mentioned above, if of higher value. For example, strips of trees are left along the sides of roads and trails to protect their scenic beauty. No cutting is allowed which will harm the water resource since protection of the watersheds was one of the primary purposes for the establishment of many of the National Forests. The Forest Service co-ordinates the development and use of all the resources and values of the land.

"During fiscal year 1951 total timber cut on National Forests exceeded four billion board feet. It is estimated that close to six billion board feet of timber could be cut from the National Forests each year without depleting the capital or 'growing stock,' as we call it, if access roads were built into remote areas. At present these high-country and back-country stands are too far from transportation.

"National Forest timber is sold on the stump. The Forest Service cruises an area to determine the amount of timber to be sold. Trees which should be cut are marked and the sale is advertised. The timber goes to the highest qualified bidder. More than 25,000 individual timber sales, large and small, are made each year.

"The names, location, size, brief description, and our work in the five representative Forests follows:

"The Kootenai National Forest, with headquarters in Libby, Montana, covers 2,053,805 acres in the northwestern corner of Montana. Of these, 1,756,093 acres are under Forest Service administration. Within our National Forests are privately owned or State owned lands over which we have no jurisdiction.

"Most of the lands within the Kootenai boundary are used for timber production. The most common trees are ponderosa pine, Englemann spruce, western larch, Douglas-fir and western white pine.

"Two-thirds of the income of the area comes from forest products. There is one major wood using industry, J. Neils Lumber Company, and a number of smaller mills. The Neils company owns much forest land, but not enough to produce sufficient timber to keep the mill and other plants going full time indefinitely. However, with timber purchased from time to time on competitive bid from our National Forest lands, it can continue without a break.

"The Kootenai National Forest reported a cut of 63,952,000 board feet during 1951, valued at $326,714.

"The Coconino National Forest covers 1,999,504 acres in central

▲ The Three Sisters, in the Willamette National Forest, Oregon. Last year over 286 million board feet were cut in this National Forest

U. S. Forest Service photos

▲ Chippewa National Forest, Minnesota, showing 125-year-old red pine. During the past year 25 million board feet were removed from this National Forest

▲ The Forest Service's caption reads: "Virgin stand of longleaf, loblolly, and shortleaf Pine sold to Crosby Lumber Company and soon to be cut over selectively." A scene in the Homochitto National Forest, Mississippi

Arizona, of which 1,830,647 are under Forest Service administration. Headquarters for the Forest are at Flagstaff.

"This Forest contains a great deal of virgin timber, mainly ponderosa pine that is over-mature. If the mature trees are not cut, they will die, decay, and be wasted. Under a carefully planned cutting system the Forest Service is taking out 35 per cent of the volume of the virgin stands. By cutting the most decrepit trees first, the remainder are left for further growth and future cutting.

"The present cut supports two large sawmills which employ 500 people, and other wood-using industries. During 1951 the Coconino cut was 85,661,000 board feet of timber valued at $341,737.

"The Willamette National Forest, headquartered at Eugene, Oregon, covers 1,819,966 acres in west central Oregon. Of these, 1,668,330 acres are administered by the Forest Service.

"When this forest was first taken over by the Forest Service in 1905, fire protection was the major problem. By 1940 the fire control forces and techniques were well organized and the road system had developed so that expanded timber harvesting was possible. That year the cut from the Forest was 56 million board feet. By 1948 the cut had increased to 207 million board feet. Last year the Forest reported a cut of 286,511,000 board feet, valued at $3,215,427.

"Another reason why timber sales were slow in getting under way on the Willamette was the proximity of good privately owned timber. Much of the National Forest Douglas-fir was high up on steep mountains and inaccessible. As this country is opened up, the annual cut on the Willamette National Forest will increase to 323 million board feet a year, the amount consistent with annual growth.

"THE HOMOCHITTO NATIONAL FOREST in southwestern Mississippi covers 373,495 acres, of which 189,153 are under the Forest Service. Headquarters are at Jackson. Most of the timber is loblolly and shortleaf pine with intermixed low-grade hardwoods.

"The Homochitto National Forest, as compared to the western forests which came to the Forest Service early in the century from the public domain, was purchased by the Federal Government starting in 1931. The big job of the Forest Service here is to improve the forest by light selective cutting of sawlogs and pulpwood. We plan to cut an amount equal to about 50 percent of annual growth. The rest is accumulated to provide larger continuous cuts in the future. During 1951 the cut was 22,844,000 board feet valued at $434,985.

"THE CHIPPEWA NATIONAL FOREST in north central Minnesota was also pretty barren when taken over by the Forest Service. It covers 2,873,292 acres, of which the Forest Service administers 1,892,024 acres. It grows a wide variety of trees—aspen, birch, sugar maple, red oak, ash, elm, cedar, balsam fir, red pine, white pine, jack pine, spruce, and tamarack. From 1923 to the early 1930's the primary aim of the Forest Service was to protect the area against fire and disease.

"The Chippewa National Forest is another rehabilitation job. Part of it came from public domain lands; part was purchased. Much planting has been on burned-over tracts. No great cuts are made from this Forest. A large number of small sales of pulpwood, bolts, and sawlogs are made. The Forest supports in part 37 sawmills. During the past year a total of 25 million board feet of timber were removed. The sale value was $125,779.

"Enclosed for further information are folders on the Willamette, Chippewa, Coconino, and Northern Region National Forests. I am also enclosing a map of the Wilderness Areas on which no cutting is done and a reprint from our yearbook, "Trees," describing the wilderness areas. We have selected a few pictures showing the timber stands of the five forests mentioned, which we hope will serve your purpose.

"If you would like further information, we would be glad to give it to you."

DANA PARKINSON
Chief, Division of Information and Education
U. S. Forest Service,
Washington, D. C.

★ ★ ★

This concludes the reply from the Forest Service to our request for information about protected forests. In it the word "cut" occurs over 20 times. In referring to one of the National Forests, Mr. Parkinson apologizes for the slowness of the cutting, occasioned by lack of facilities for getting at the timber. Over $3 million worth of wood was cut in that one Forest last year, but a greater yearly cut is promised.

We asked to see the National Forests that the Forest Service wants to save. We seem to have been given the National Forests they want to cut.

The people at the Forest Service have been exceedingly courteous, and we appreciate that. Nor are we implying that everyone wants to save the National Forests.

We realize that one aspect of Forest Service policy has to do with what is called "sustained yield," but that is not the part we asked about. The people in charge of the National Forests surely gave our readers the impression they had forests that ought to be preserved; but when we opened the package, we found that it had something else in it. If we picked up somebody else's groceries, we're certainly ready to apologize. But it does look as though we asked for six jars of preserves and found when we got home that we had five baskets of ripe plums, with the directions: "Eat at once to avoid spoilage."

There was one parcel we hadn't looked into. Both the Chief of the Forest Service and his Chief of Information and Education referred us to what are known as "Wilderness Areas." None of the photographs they sent showed them. Could that be where the great tracts of virgin forest stand—safe for the future?

No, I can do no better than quote from the Forest Service's own description of these lands. In the volume that Mr. Parkinson refers to as "our yearbook" (*Yearbook of Agriculture,* 1949), we learn that these Wilderness Areas "are usually the least productive of commercially valuable timber; considerable portions are above the timber line or have only non-commercial timber growth."

In the same book, we also learn that whatever timber these Wilderness Areas contain can be logged off at the discretion of the Secretary of Agriculture at any time unless a public protest is voiced within 90 days after publication of the contemplated order.

Those who think that the Forest Service should operate its business intensively for the sake of immediate profits may argue that the National Forests are not being cut fast enough. But those who would have read with delight that some of the 2½ percent of our land still in virgin forest is to be preserved permanently will search in vain for specific assurance on the aspect of forest conservation that is dearest to their hearts.

Before asking anyone to search further for these forests that want preserving, perhaps we had better ask how many of our readers really care about them. Why don't you let us know?

EDWARD WEYER, JR., *Editor*

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PORTRAIT OF A VAMPIRE

Continued from page 87

cisors, and commences nonchalantly to lap up the blood.

The favorite victims are cattle, horses, goats, sheep, pigs, dogs, and poultry. Cats, strangely enough, seem to be spared. Preference is given to dark-colored animals, and when black-and-white animals are attacked, the bites are made on the black patches. Ordinarily the vampire does not bother with humans when livestock are available for a bloody repast, but when the usual supply is cut off, such as during an epidemic, humans will also be attacked.

The most vivid and detailed description on record of an attack by a vampire bat on an animal is Dr. Greenhall's. In August, 1934, he placed a goat in the same cage with a healthy bat. For a while the bat remained motionless, but it soon swung into action. "The head nodded; the lips were drawn back, exposing the large canines and protruding incisor teeth." At last it stared at the goat, and slowly and deliberately it descended the screen, stalking its victim. "Suddenly and silently the vampire launched itself into the air and lightly landed on the middle portion of the goat's back." It strode to the neck and shoulder, searched around for a minute or so, and then "buried its head close to the skin of the goat. There were a few up and down motions of the bat's head. . . . The goat walked around the room rather rapidly, the vampire hanging on and thus riding its host." As the goat passed Dr. Greenhall, he saw blood oozing from a tiny wound, "and the bat was lapping it with a rapid darting of the tongue." The goat was now restless, running around in an excited manner, but it seemed more in terror of its human observers than of the creature riding on its back. "The wandering of the bat upon the strangely tolerant host, the occasional lifting of the bat's head, the leer that disclosed its keen teeth, and the observer's realization that all this pointed to a sanguineous meal, produced a sinister and impressive effect."

All the evidence from a variety of sources indicates that the bite of the vampire is remarkably painless. Young, inexperienced bats, however, may awaken the sleeper with a painful bite. When humans are attacked, the most favored site is the toe—possibly because there the bat is least disturbed by movements of the sleeper's body. But the vampire also favors the tip of the elbow, nose, or ear, and it will even bite through mosquito netting where part of the body is in contact with it. The wound made is only a quarter of an inch long and an eighth of an inch wide, but the hemorrhage is rather profuse. Dr. Pawan declares that not only does the sleeper feel no pain, but he actually has a "rather happy and soothed feeling" during the bleeding.

Dr. A. G. Ruthven, a zoologist of note and President of the University of Michigan, once had an experience illustrating this peculiar phenomenon while on an exploring trip in Santa Marta, Colombia. "We did sleep," he wrote, "but so soundly that it was not until morning that we discovered that we had been raided during the night by vampire bats, and the whole party was covered with blood stains from the many bites of these bats. It may seem unreasonable to the uninitiated that we could have been thus bitten and not be disturbed in our sleep, but the fact is that there is no pain produced at the time of the bite, nor indeed for some hours afterward." The records of the Medical Inspector of Health in Trinidad show that of 87 people bitten in 1935, 27 were actually awakened by the attack. The remainder first found out about their nocturnal visitors in the morning.

Some investigators, including Dr. Pawan, have attributed the heavy bleeding induced by the bite to an anticoagulant in the bat's saliva, but the evidence for this is still inconclusive. The areas where animals have been bitten show up as bare spots denuded of hair, about the size of a thumbnail. Bats have a tendency to return regularly to the wounds made during previous raids. If it is undisturbed, the bat will gorge itself into a sphere and may barely be able to retire to digest its repast. Dr. Greenhall saw a vampire get so heavy during feeding that it slid off the back of the goat and was unable to launch itself in flight.

During the day the vampire sleeps in a cave or hollow tree, or it may also repose in such secluded and unfrequented places as underground drains, old iron and concrete ruins, abandoned dilapidated houses, empty garrets, cellars, and wells that have fallen into disuse. While at rest, the bats hang downward, clustered together like enormous masses of spiders, and when the light from a flaring torch first reveals their presence in the innermost recesses of a cave, even the most hardened students of these creatures experience a spine-tingling sensation. The vampire has an eerie habit not shared by other bats. When its slumber is disturbed, it grins malevolently at the intruder. Then, leisurely and nonchalantly, like a wary mouse, it walks backward, finally disappearing into a crevice.

With sundown, the vampires emerge from their hiding places, ready for their nightly forays. In flight they have the swift unerring grace of swallows, and they utter shrill high-pitched cries. This is the bat's own special brand of "radar" for avoiding obstacles in the dark, because the sound waves bounce back from solid objects to warn the bat of an impending collision. This ingenious system was apparently impaired among the rabid bats in Trinidad that flew around in broad sunshine, crashing crazily into walls and fences.

After its first repast of blood early in the night, the bat is so bloodlogged that it must retreat to a digesting-place. Often this is a nearby stable or the underpart of a bridge. These retreats as well as other sleeping hideaways can be detected by means of the bat's characteristic tarry, brownish excrement. This drips down from the roosting bats and collects into a large pool, often three inches deep, which has a strong ammoniacal smell. Scouting parties out to capture or destroy vampire bats can discover their lairs by means of these pools.

Dr. Harald N. Johnson, of the Rockefeller Foundation's International Health Division, has had considerable experience in capturing large numbers of vampire bats in Mexico. Associated with him on these bizarre expeditions was the distinguished animal pathologist, Dr. A. Tellez Giron, of the Mexican Department of Agriculture. They found the caves frequented by vampires high up on the sides of arroyos and mountain ridges by means of the telltale pools of bloody excreta near the cave's entrance. Sundown proved to be the best time to capture these creatures, and the party would arrive at the cave at that time, stretch a net loosely across the entrance, and settle down in the eerie stillness to await the emergence of the bats. When the creatures started coming out, the men would begin throwing rocks. This racket disturbed the vampires so much that they would fly into the net to be captured. In removing them from the net, the men wore heavy leather gloves, and it was fortunate for them that they had this protection. The bats bit into the gloves with such savage fury that they made deep grooves in the leather. One pair of leather gloves that Dr. Greenhall used eventually became so bitten up that they literally disintegrated.

Bat-hunting trips were also made during the daytime when vampire hangouts were found among hollow trees with pools of excrement at the bottom. A net would be placed over the opening, and all the other exits from the tree would be plugged. Then a smudge fire would be made with dried cow dung inside the tree, and in several minutes the bats would start falling into the net. In one such tree, Dr. Johnson found 20 bats. He frankly confesses to having liked the tree hunts much better than the weird sundown expeditions to the lonely caves.

For over a half-century a deadly paralytic disease has been a major plague of the livestock industry in Mexico. Known by the Spanish name of derriengue (pronounced derri-en-gay, meaning "to break the spine"), this highly fatal illness has been estimated to destroy hundreds

of thousands of cattle each year. The Mexican agricultural scientists were at a loss to account for the origin of the disease, although Dr. Tellez Giron had in the early thirties isolated from cattle a virus that resembled the agent responsible for causing rabies. Veterinarians, however, pooh-poohed the notion that this was a rabies virus, because the disease occurred in areas where rabid dogs were unknown.

In 1943, Dr. Carl Ten Broeck, of the Rockefeller Institute for Medical Research, went to Mexico to look into this problem. From the brain of a cow ill with derriengue he later isolated a virus that showed definite similarities to known strains of rabies virus. In 1944, the Rockefeller Foundation sent Dr. Johnson to help the Mexican workers find out more about the virus and its mode of transmission to livestock. The outbreaks of the disease had originally occurred close to the coast, but they progressively became more and more common inland, particularly in valleys. Most of the cases developed between October and April; they affected cattle, horses, and burros. Sheep and swine, on the other hand, rarely got the disease.

Drs. Tellez Giron and Johnson later found rabies virus in the salivary glands and brain of a paralyzed cow and also in similar organs of vampire bats captured in a nearby cave. After a systematic investigation, they reached the conclusion that the long-mysterious derriengue was actually rabies transmitted by vampire bats.

Right now Trinidad is again having its troubles with bat rabies, and an outbreak of this disease also occurred recently in Honduras. In 1950, the United States Public Health Service dispatched a veterinarian specializing in rabies to aid the Mexican health authorities, who had requested assistance in fighting still another epidemic of derriengue. In the spring of 1951, events took an ominous turn in that country. In the village of Platanito, in the State of Sinaloa, a farmer was awakened during the night by the screaming of his children. By the light of a lamp, he saw a dark shadow hurtling itself at one of his children and later shoot out through the door. The children were bleeding from fresh wounds on their necks, faces, and arms.

When the farmer heard yells from the hut of a neighbor, he looked out the door and saw a bat flying toward him. He grabbed it, threw it on the ground, and crushed it with his feet—but not before it bit him on a finger. It was not long thereafter that the farmer, three of his children, and one of his neighbor's youngsters died of rabies. The vampire bats in that village were later exterminated by specialists rushed over from Mexico City, who burned and smoked them out from trees, caves, and vacant dwellings.

Once alerted to the sinister role of vampire bats in the spread of rabies, the health authorities of Trinidad and Mexico invoked stern protective measures against these creatures. Stables have been enclosed with wire netting to prevent the entry of the bats, but there was one man in Trinidad who kept on losing livestock even after he had bat-proofed his stables and kept his animals indoors at night. It was later discovered that bats were actually crawling through a narrow space under a door to attack the beasts.

In Trinadad trained squads go out on bat-destroying expeditions, routing the vampires out of their resting places with cyanide dust and with fumes of burning sulphur, and shooting those that try to escape. A thick paste of strychnine is also applied to the old wounds on livestock, and because of the bats' predilection for returning to such favored spots, large numbers of them are poisoned. The physicians in Trinidad now lose no time in instituting a course of antirabies injections when patients are bitten by bats, and the results so far have been excellent in saving lives. Such a program will evidently have to be inaugurated in Mexico, too.

How did the rabies virus get into the vampire bat in the first place? The vampire, incidentally, is not the only type of bat that can harbor the virus—rabid fruit-eating and insectivorous bats have also been found, and some of these have actually attacked humans in Trinidad. The dog has traditionally been the favored host of the rabies virus, and this was known to the ancient Egyptians, Greeks, and Romans. The chances are that the rabies virus originally strayed into bats through the attacks on these animals by rabid dogs. When a parasite migrates to a new host, a transformation often takes place in its make-up and way of life. This alteration unquestionably took place when the rabies virus found the bat a congenial host. The virus also changed its properties, so that in many respects it differs from the classical rabies virus. This is reflected by variations from the traditional symptoms of rabid animals, as well as by changes in the serological properties of the virus when tested against the blood sera of animals previously injected with standard rabies virus. The virus hit upon a particularly successful choice in selecting the vampire, because the latter's biting propensities offer a convenient means of spreading it to other animals.

Bats do not only attack livestock and humans but also other bats, particularly during the breeding season, when males struggle for supremacy. In this manner, the virus is kept going among the vampires. If it were not for this, the disease would eventually die out in these animals, because strange as it may seem, uninfected bats cannot acquire rabies by lapping the blood of rabid livestock.

But rabies of humans and livestock is now a major public health and economic problem of the American tropics. The authorities are firmly convinced that there can be only one answer to this problem: the extermination of the vampire bat wherever it is found.

Residents of more temperate regions will be relieved to know that there are no vampire bats north of Mexico. All the bats in the United States are beneficial as insect eaters.—Ed.

UNDERGROUND WITH BURROWING OWLS

Continued from page 81

based on fact—even though the fact had been misconstrued in the telling.

About a week after the young became proficient flyers, the ranch got one of those sudden rainstorms that convert dry gullies into raging rivers. The nest and tunnel became a hopeless muddy mess. But even in this minor disaster, more was to be learned about burrowing owls. The following morning, fledglings and parents had gathered together on a prairie-dog mound about 100 yards away. From afar I realized that they were waging a battle for possession of the burrow. Each time the rodent owner of the burrow came within about 20 feet of the mound, an adult owl hovered on rapidly beating wings. And at the slightest intimation that the prairie dog was going to make a shouldering rush to the entrance, the bird would swoop and rake its back. After several attacks from above, the prairie dog seemed to lose interest in repossession, and when I approached for a closer view, it sought refuge in a burrow many feet away.

So my experiment produced no evidence to give validity to the belief that there is a "happy family" relationship among these three animals. Throughout the weeks of intermittent observation, two-thirds of the cast in the "happy family" story (the dogs and the owls) were in constant sight; but their actions, when crowded, definitely showed that harmonious feelings did not exist. The rattlesnake, third member of the cast, failed to put in an appearance, but a perfect imitation of its familiar sound had been created by the fledgling owls. Now I can't help feeling that this instinctive mimicry formed the original basis for the yarn and that even to the present day, when heard but not investigated, it perpetuates the false story.

Perhaps the birds do nest in holes that have been used by reptiles, and perhaps rattlers hibernate in holes that were formerly owl nests. In each case, however, the tenancy must almost necessarily be successional and not simultaneous. There are only a few days in the spring and a few in the fall when snakes are really to be found concentrated about dog colonies. Throughout the remainder of fall, winter, and early spring the reptiles are deep underground in a slumber that will hold them until the following spring.

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BOOKS

Continued from page 54

For these two romantic episodes the author does little more than paraphrase the original accounts, but in outlining the supposed modern knowledge of this area he becomes involved in numerous inaccuracies and makes many statements indicating his information to be at least 20 years out of date. The latter is also very apparent in the bibliography at the end of the book.

It is a book uneven in quality and certainly not to be taken as a scientifically accurate survey of the history of archaeology or of archaeological knowledge. It serves primarily to release from the weighty archaeological monographs and make available to a wider audience some of the glamor and romance inherent in the archaeologist's quest.

Gordon F. Ekholm

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THE SEA AROUND US

- - - - - - - - by Rachel L. Carson

Oxford Univ. Press, $3.50
230 pp.

IT is rare, indeed, that this reviewer has seen such understanding care for technical accuracy so well combined with a pleasing literary style as in *The Sea Around Us*. Miss Carson's work well deserves its present place near the top of the nonfiction best seller list.

The author has given an account of many of the principle aspects of modern oceanography, starting with the classical story of the formation of the earth and the condensation of the sea in the form of rain. This is the least satisfactory chapter in the book. Although there is general dispute about almost every suggested geogonic process, one of the few ideas to have found wide acceptance is that the primeval sea was salt and that at least the greater part of the water was released from the earth crust by physical and chemical means. Almost the only "sea salts" leached out from the land into the sea are those that were once part of the ocean. This "salt cycle" is well discussed by Miss Carson in a later chapter, except that the explanation there advanced to account for the difference in the salt carried by rivers and that found in the sea has been shown in recent years to be unsound.

The next two chapters, dealing with the surface of the sea, discuss the swimming and drifting life of the open water and the effect of the seasons. They contain an interesting description of the Sargasso Sea, which, as Miss Carson points out, is not matched in any of the other ocean basins, whose central regions have been called marine deserts. It should also be noted, however, that the surface plankton in the Sargasso Sea is still extremely scanty in comparison with the colder part of the Atlantic. It is a minor point, but comb jellies do not have "paralyzing tentacles" as stated on page 19.

The description of the deep sea in the following chapter contains the first extensive popular discussion of the newly found scattering layer, that amazing dense layer of unknown organisms, which echo-sounders have discovered in mid-water.

In common with most other writers, Miss Carson pictures the deep sea as "A world only a little less hostile than the black reaches of interplanetary space." Actually, I think that this involves more than a bit of anthropomorphic thinking. Once a deep sea animal has acquired the basic adaptation to pressure, cold, darkness, etc., the rest of its racial existence is passed in a uniform, unchanging environment, which presents no further challenges. Thus we find all sorts of structurally inefficient deep sea creatures who would probably be rapidly wiped out in the harsher conditions of the shallow seas.

The discussion of the ocean floor was probably the most up-to-date when written. The intensive work on submarine geology sponsored by the U. S. Office of Naval Research has brought in an immense amount of new and sometimes startling data but, in the main, the picture given by Miss Carson is still acceptable. It should be noted, though, that Dr. Francis Shephard, one of the most convincing proponents of the theory of sub-aerial erosion of submarine canyons, which called for the withdrawal of several thousand feet of ocean water during the glacial age, now believes that the new evidence renders such a view obsolete. Probably no more than 300 to 500 feet were withdrawn.

The next section of the book deals with movements of the water waves, currents, and tides. Although here again the progress of research has been particularly rapid since these chapters were written, they do give as good a discussion as can yet be had and contain a wealth of interesting historical information. In these days of powerful luxury liners it is easy to forget that once vessels might wait as long as three months for a favorable wind to pass out of the straits of Gibraltar (p. 149). The last chapter is devoted to a short history of men's ideas about the ocean.

John C. Armstrong

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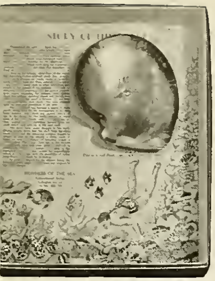
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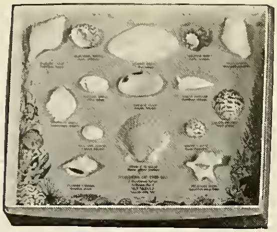
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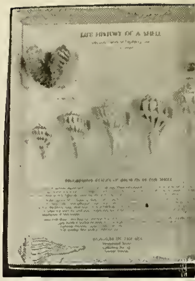
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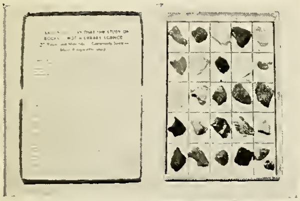

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March 15 . . .
What's the matter, Pa? Has that man been here again?

LETTERS

Jumbo's Private Car

Sirs:

George Goodwin's recent article about Jumbo reminds me that in Washington at the Zoo I knew William Blackburne, former animal man with the Barnum Show. He told me that Jumbo had a railroad car of his own. The keeper slept in one end, partitioned off from the elephant, but Jumbo always wanted the sliding door between the two sections left open so he would not be alone. He would put his trunk through the opening to see if the keeper was really there.

Charles R. Knight.

New York, N. Y.

The National Parks and Hunting

Sirs:

. . . In his article entitled "Do You Want Hunting in National Parks?" Mr. Murie gave me the feeling that he felt that in general hunters were not nature lovers. I disagree with this and believe that an increasing percentage of the modern generation of hunters do definitely love the outdoors more than they enjoy killing wildlife. I think one can also say fairly that the vast majority of the tourists who visit the National Parks do very little besides drive through and maybe have a picnic. . .

I am very much in sympathy with the National Park idea, and I think the Parks are well-run. I think the policy of allowing these parks to be as natural as possible and to allow the timber to grow to maturity and old age without any cutting is good, because certainly we can spare this small amount of America as a memorial to the past. I do not, however, think it a sacrilege to harvest some of the wildlife of the National Parks. My reason for this is that the National Park is not now, and never will be, the same as it was before the white man came. For example, in the Shenandoah National Park there are no longer any mountain lions or wolves. Therefore, the deer have practically no natural enemies except disease. . .

Incidentally, you are probably aware that many thousands of modern American hunters have turned to the bow and arrow. Perhaps this form of hunting would be acceptable to the nature loving public and to the Park Service as a permissible way for the public to enjoy the National Parks.

In short, I simply want to state that there is some argument in favor of enlarging the usefulness of the National Parks in the form of controlled hunting, either with firearms or perhaps only with bow and arrow. The latter, of course, would be safer.

McKelden Smith, M. D.

Staunton, Va.

Sirs:

"Do You Want Hunting in National Parks?" Of course not. What must we do about it? What will it cost? I'll pay my share to stop the "sportsmen." What is your program to fight those birds and

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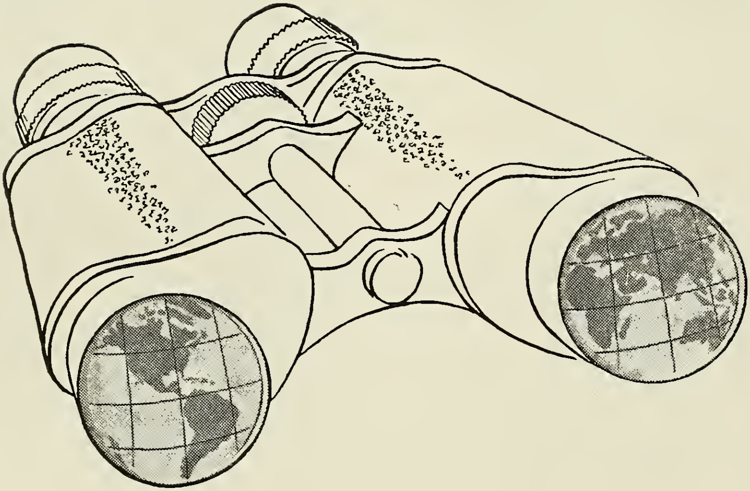

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VOLUME LXI—No. 3
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THE COVER THIS MONTH

This Chamula sub-chief of the Mexican state of Chiapas was photographed on the occasion of an important conclave in the capital town of San Juan Chamula.

Twenty-six thousand of these Chamula Indians live scattered among the pine-clad mountains of Mexico's southernmost state. They are grouped in 62 *parajes*, or small civic centers, with the village of San Juan Chamula as their center. Once a year, the purely Indian government is changed, and on the morning of December 31, the new minor chiefs concentrate in the capital to pay their respects to the big chief, the "Presidente" of San Juan.

The photograph shows one of these sub-chiefs in all his regalia. Under his arm he carries his silver-topped cane, sign of authority.

The picture was taken by Gertrude Duby de Blom, who resides with her husband, Dr. Franz Blom, in the picturesque town of San Cristobal Las Casas, the old Spanish colonial capital of the state.

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YOUR NEW BOOKS

Forbidden Nepal • Arizona's Bird Life
Marston Bates on the Tropics • Photography

WHERE WINTER NEVER COMES

- - - - - - - - - - by Marston Bates

Charles Scribner's Sons, $3.50,
310 pp., 29 illus.

THE subtitle of this book states that it is "A Study of Man and Nature in the Tropics." The author has had an extensive experience in the tropics; he is greatly interested in the various factors that make the tropics different from the temperate regions; and he has given much thought to the role played by man in a tropical environment. The scope covered by this book is tremendous and ranges all the way from a broad treatment of the environmental factors that characterize the tropics to the aspects revolving about man—historical, cultural, political, and hygienic. Bates has his own personal reactions to many of the moot questions involved in man's conquest of the tropics or, on the other side of the coin, in the tropics' influence on man. He draws freely upon the published opinions of others, and the reader has the evidence pro and con. The book is well documented.

This sort of book, like a good meal, requires deliberation, pauses for savor, and time for digestion. In some respects the treatment touches upon a geography (in its broadest sense) of the world. The chapter "Clothes Make the Man" will illustrate this point. Bates tells in a very entertaining fashion how clothes have evolved over a wide climatic range—fitted clothes in the Arctic, draped garments in the tropics, trousers coming into prominence in the Dark Ages, and how considerations of status, caste, and religion have superseded the utilitarian function of clothes. The reader considers the topic of outer coverings after a briefing that should provide a good basis for logical conclusions.

To the average reader, the tropics connote special environmental characteristics and particular precautions that man must take if he is to live there. Such chapters as "Tropical Diseases," "Food and Drink," "The Rain Forest," "On Tropical Climates," supply this expected information.

The subject is a big one, and so is the book.

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SEARCH FOR THE SPINY BABBLER

An Adventure in Nepal

- - - - - - - - - - by Dillon Ripley

Houghton Mifflin Co., $4.00,
301 pp., 18 photos, 1 map

IN recent months the Kingdom of Nepal has been much in the news, because of revolts and its situation right between Tibet and the new democracy of India. Doctor Ripley's book is timely, with its excellent account of life in Nepal and a vivid picture of the Court at Katmandu only three years ago. The spiny babbler is a minor item in this informative and readable book.

The long band of mountainous country just south of the great Himalayan Range is intensely attractive to naturalists. To assay the changes in its birds from east to west, their altitudinal distribution between the hot plains and icy mountains near Everest, more information was essential from Nepal, where few visitors were allowed to stray beyond the capital.

In order to travel more widely, Ripley applied all his diplomatic arts to approach the rulers at Katmandu, and he obtained the sponsorship of three leading institutions in America. Visiting first the Maharajah, he went on to mountainous areas on both the western and eastern sides of Nepal, with a party composed of naturalists and expert photographers. A number of Indians and Nepalis assisted; to them the antics of American naturalists seemed no doubt as amusing and paradoxical as their own behavior is portrayed to us.

Of three very rare birds sought, only the Spiny Babbler was collected; but the real task was to gather as wide a variety of birds as possible. That was done most successfully. A modicum of ornithological knowledge, while not essential, will greatly enhance the reader's delight. The "Index of Birds" is helpful, but it cannot always teach the uninitiated to recognize a Coppersmith Barbet, Minivet, or Black-capped Sibia, if and when encountered.

Wide deforestation and ugly soil erosion are saddening notes. The people of Nepal are described with friendly insight, its gorgeous mountain scenery depicted with admirable skill. Few can hope to visit that country, but here we may learn much about the homeland of the brave Gurkhas.

JAMES P. CHAPIN

DANA'S SYSTEM OF MINERALOGY, VOL. II

- - - - by Charles Palache, Harry Berman and Clifford Frondel

John Wiley and Sons, Inc., $15.00
1124 pp.

AFTER a wait of seven years, the second volume of the three-volume Seventh Edition of this classic of mineralogy has at last appeared. The first volume covered the elements, sulphides, and oxides. This one completes the mineral

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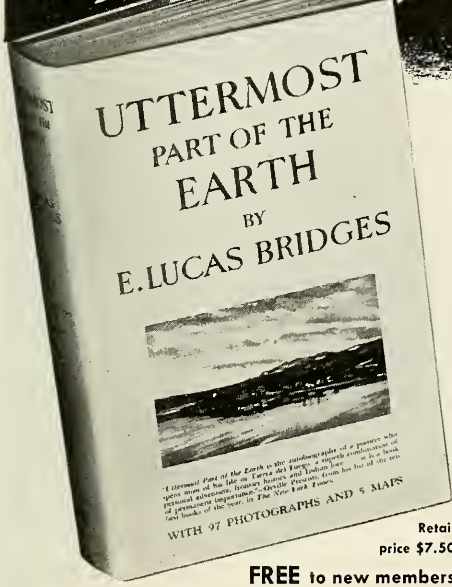

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F. H. Pough

HIGH ADVENTURE

Text by Norma and Patricia Spring
Photographs by Bob and Ira Spring

Superior Publishing Company, $8.50
115 pp., 143 illus.

THIS is the first major attempt by Americans to present a book of American mountaineering photographs. Alpine photography, brought to superb perfection by Europeans many years ago, has been an almost completely neglected field in this country. But the Springs' maiden venture shows them to be masters worthy to rank with the best Europeans, such as Andre Roch and E. A. Heiniger.

Here is a series of magnificent photographs, taken in the Cascade Range, Olympic Mountains, and Canadian Rockies, which carry you from base camps in flowery timberline meadows up into the mysterious and fascinating realm of snow and ice to remote white summits in the sky. These pictures directly communicate the unexplainable exhilaration in the sport of mountaineering, and they almost answer that unanswerable question, "Why climb mountains?"

Competent photographers below the snow line, Bob and Ira Spring become inspired in the high world among the glaciers, and no Americans can rival their instinctive feeling for the texture, composition, grandeur and power of moving ice. But their pictures are not simply instinctive. They also show careful and painstaking workmanship and demonstrate how close to true art mountaineering photography can come.

The text by the photographers' wives is sprightly, amusing, and readable. It tells in a light, humorous vein the difficulties of the distaff side keeping up with the determined, dominant males who love to climb mountains and have made mountain photography their living. But unfortunately for the book, pictures and text tell different stories. The former boldly preaches the inspiration and glories to be found in high mountains; the latter humorously relates the backaches, drudgeries, and discomforts of mountaineering. Of compensations—hardly a word. One almost wonders why the girls go along.

But all in all, *High Adventure* is a book that glowingly reveals a whole world of amazing natural history above the snow line.

Weldon F. Heald

ARIZONA AND ITS BIRD LIFE

- - - - - - - - by Herbert Brandt

Bird Research Foundation,
Cleveland, $15.00
725 pp., 62 illus. (18 in color)

WHEN Herbert Brandt writes a book, it is sumptuous. He has done it before in *Texas Bird Adventures* (1938), and very notably in *Alaska Bird Trails* (1943), the latter including an account of his trek by dogsled to the Yukon delta. Now he has devoted 725 quarto pages, 62 reproductions of photographs, sketches, diagrams, maps, and paintings (18 color plates) not to Arizona as a whole but rather to desert, grassland, foothill, and mountain in a southeastern corner that comprises one-ninth of the area of a state twice the size of all New England.

The paintings of birds in their appropriate environments are by Brooks, Peterson, Shortt, and Sutton. They deal in large measure with spectacular species of tropical affinities, such as the coppery-tailed trogon, Richmond's becard, pyrrhuloxia, the Rivoli, and blue-throated hummingbirds, painted redstart, and red-faced warbler, although there is also a goodly showing of songsters, game birds, and birds of prey of types that have a wider distribution in the United States.

If the author has any fault, it is the generous one of eloquent praise for all his collaborators. These include not only the artists but also his chief ornithological mentor Dr. H. C. Oberholser, members of his family and other fellow workers, his hosts and helpers in the field, and the friends who have supplied photographic illustrations. The latter are all pertinent and mostly excellent, though one by Maslowski, facing page 40, looks as though it needed acknowledgment of heavy retouching. A diagram by the author, depicting a zonal cross section of the area covered by the book, is extremely useful for comprehending the interrelations of climate, physiography, and life.

The text is a colorful record by a naturalist who has enjoyed every experience to the full. He mingles exposition skillfully with narrative in describing the terrain and the biotic associations. The accounts of the birds are likewise tied up closely with the subjective realm of search and companionship afield. They include, however, many new and shrewd observations on nesting behavior and on the ecological niches of country that varies both abruptly and extensively. The final section, covering 68 pages, is a concise annotated list of the breeding birds of the area.

From this major report, ornithologists will be able to derive a wealth of quantitative information. Aside from that, the hostels, tourist agencies, and chambers of commerce in Arizona should give the author a medal for his picturing of the charms of their state.

R. C. M.

PHOTOGRAPHY AFIELD

- - - - - - by Ormal I. Sprungman

The Stackpole Company
Harrisburg, Pa., $7.50
449 pp., 256 illus.

DRAWING on his years of experience as a photographic columnist in *Sports Afield*, Mr. Sprungman has created a profusely illustrated book that should answer any sportsman's questions about what equipment he should own, what sort of pictures he ought to be able to take when on his trips, and how to take them.

The book is almost an encyclopedia

Continued on page 143

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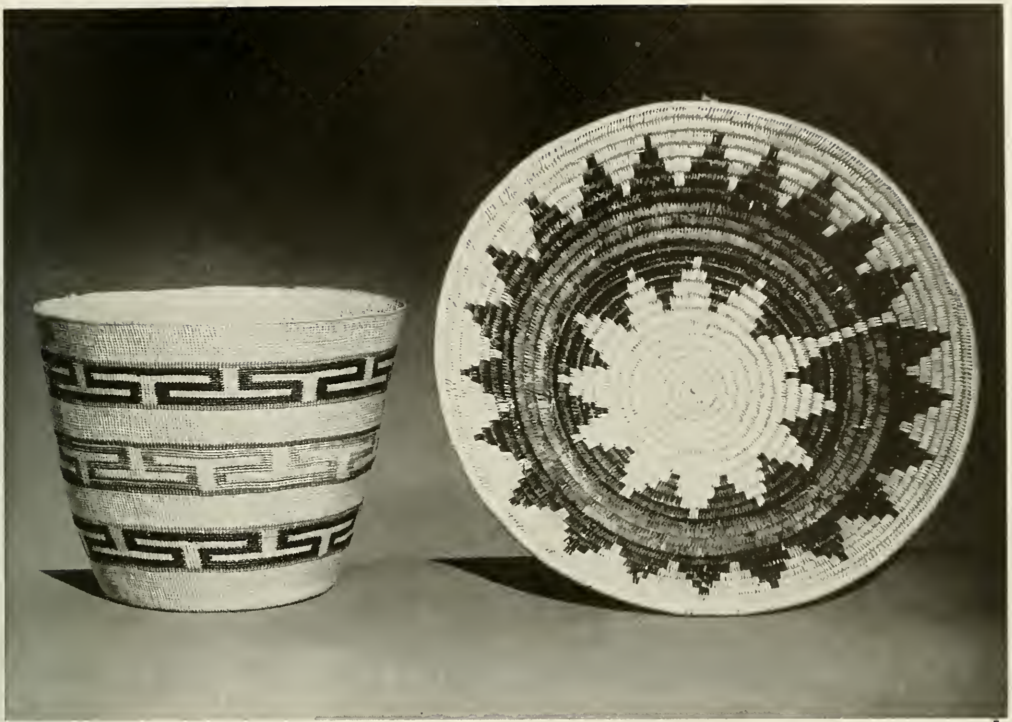

These rare baskets collected over fifty years ago are examples of a lost Indian art

On the left, an Alaskan Tlingit basket made by the Yakutat. These baskets represent a type of the finest twined weaving with the use of brilliant colors and geometrical designs. About 11 inches in diameter and 10 inches high. **$45.00**

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On the right, a tray of coiled natural grasses, used by the Navajos in the wedding ceremony. Although the colors used are beige, brown, and black, the total effect is one of brightness. About 15 inches in diameter, 4 inches deep. **$36.00**

The above baskets are an exceptional opportunity for collectors and decorators, as these baskets have not been made for many years and are seldom found outside museums.

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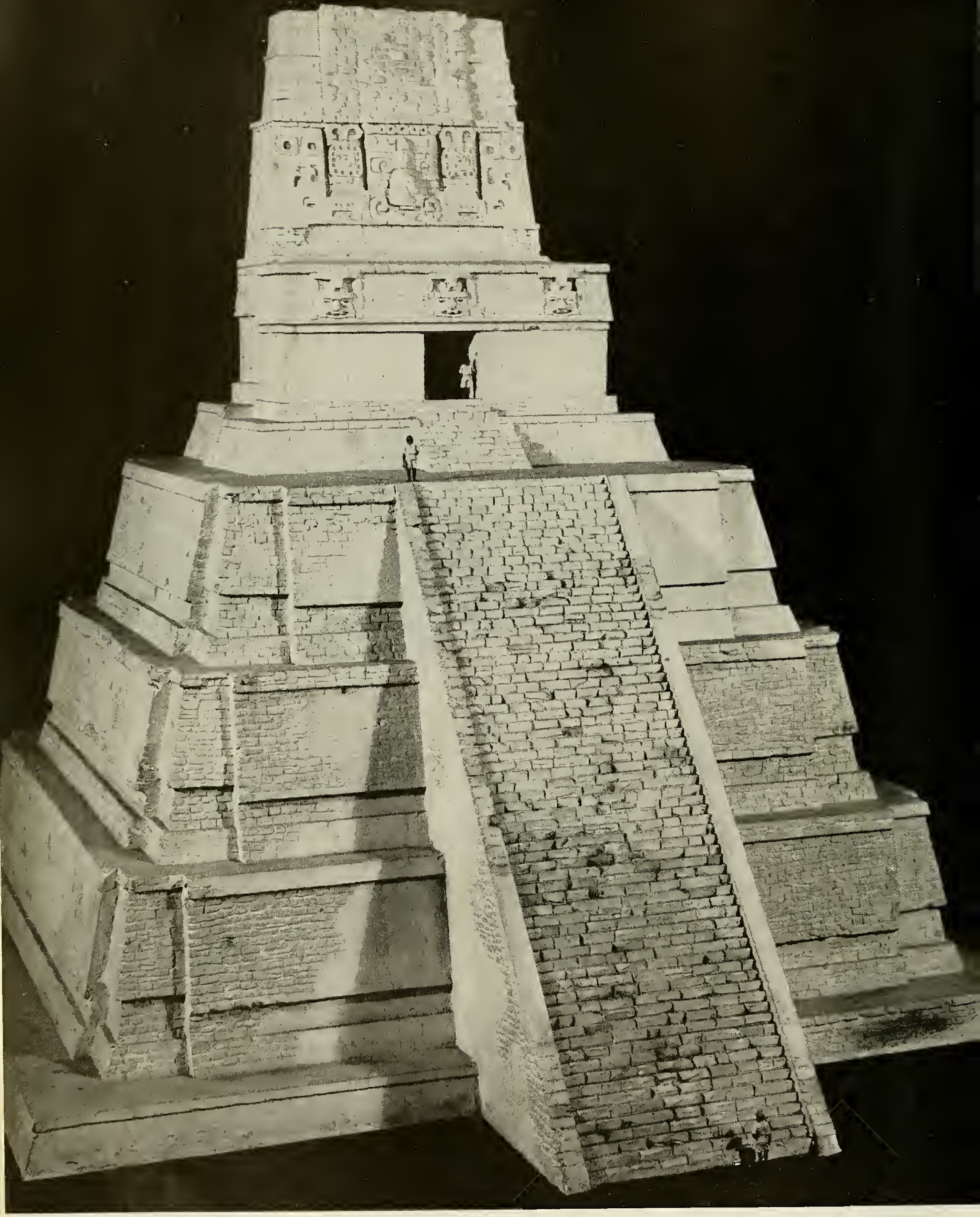

▲ MODEL of a Maya Temple at Tikal, in the American Museum. The shape of this and similar pyramidal bases suggests the pyramids of Egypt, but they are wholly unlike in structure and arrangement

Maya Metropolis

A plunge into Guatemala's jungle to the "lost city" of Tikal—fabulous heirloom of a Golden Age rivaling any elsewhere in the Western World

By KENNETH L. GOSNER*

Photographs by the author unless otherwise credited

SCATTERED abundantly throughout the length and breadth of the Yucatán Peninsula are the material remains of a populous civilization that flourished 1000 years before the Spaniards first reached the New World. On the forest-covered plains of northern Petén, at the base of the Peninsula, the first tender shoots of the Maya culture rose timidly among the giants of a mighty forest. The peaks of achievement that these people reached in art and science have been compared with the best of the ancient civilizations of the Old World, and they had few equals on the American continent. Rising to a wonderful maturity, the Mayas flowered and finally died in what is, today, a vast tropical wilderness.

The jungle, which they pushed back in creating their civilization, returned to the abandoned fields and hamlets, covering these and their great cities with an equally impenetrable growth. Only the crumbling fragments of a nearly forgotten splendor survive. The ancient Mayas are gone.

Of their major centers, the largest and least accessible is the metropolis of Tikal. Though hardly more than an hour's flight from the cool, pine-forested highlands, the ruins of Tikal lie on the flat and hot lowland area south of that invisible line that marks the frontier between Guatemala and the Mexican state of Campeche. For the past ten years or more the easiest approach to the abandoned site has been by plane from Guatemala City to the airfield at Uaxactun and thence by mule trail.

This bush camp is serviced twice weekly by the Compañia Guatemalteca de Aviación; and through the generosity of the Wrigley Import Company, which operates a half-dozen chicle camps throughout the Petén, we found a place to sling our hammocks while furthering our plans for a visit to the ruins.

We set out before the sun had quite dispelled the last of an early-morning mist from the Uaxactun clearing. Tikal is less than a dozen miles nearly due south of the little bush camp from which our journey began, but we had been forewarned of an arduous all-day trip. We placed the success of our venture and our own well-being in the competent hands of Gregorio Javier, who had guided a party to the "lost city" several years before.

Across the airstrip we jogged, through someone's back yard, and down the path that skirts a large milpa, or cornfield, at the south end of the village. Very quickly we were in the bush, and the trees closed overhead. The warm glow of the morning sun filtered through the green canopy above, but little of its golden light reached the forest floor.

The immense wilderness that clothes the Caribbean hinterland of Guatemala is a semievergreen rain forest. Nurtured by the moist winds that sweep in from the sea, this jungle reaches its greatest luxuriance along the slopes of the Vera Paz at the foot of the high Sierra, while northward the dense forest grades imperceptibly into the dry and thorny thickets of the outer rim of the Peninsula.

Giant trees—sapodilla, mahogany, *ramon*, and bulbous-trunked ceibas—sent their boles upward, straight and branchless, 100 feet in search

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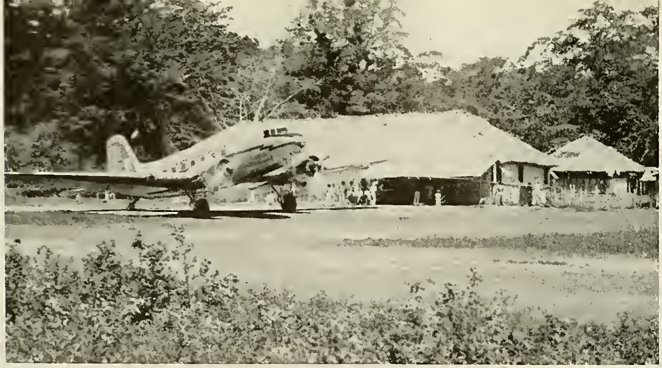
*EXPLORER, artist, and writer, Mr. Gosner is well qualified to write about this unique ruin in Guatemala. He has been on the Science Staff of the Newark Museum since 1946.

The background for this article was secured on two trips to the Department of El Petén, Guatemala, in 1947 and 1949. On the first trip he collected mammal skins and reptiles, which are now in the collections of the American Museum of Natural History. On the second trip he recorded temperature records for the American Museum's Department of Reptiles and Amphibians.

Mr. Gosner served as field artist for the 1946 expedition of the New York Zoological Society to Rancho Grande, Venezuela. He has also made summer field trips to El Salvador, Honduras, Yucatán, and Mexico.—ED.



◄ **The plane** from Guatemala City lands you at the Uaxactun airstrip. In the background is the "Administration Building." From here the arduous muleback journey to Tikal begins

of light. Along the trail were places rank with the heavy sweetness of the Spanish Cedar, whose fallen blossoms littered the ground beneath the towering magnitude of the tree itself. Where the footing was precarious, many of the big trees sent out great flanking buttresses to prop and maintain them in the shallow soil.

Up and around, clinging tenaciously, grew multitudinous vines, and from the branches far above, pendulous lianas hung nearly to the ground. Heavy masses of *Philodendron* and *Monstera* festooned the soaring giants, concealing their trunks beneath monstrous fleshy leaves and tendrils. Among the forest dominants were lesser trees —willowy *Cecropias* with odd palmate leaves growing from whispy clusters at the top; palms, spiny and treacherous; and others loosely anchored in the limestone soil.

It was July of a very dry year, and the forest reverberated with the throbbing roar of cicadas. With the rising crescendo that characterizes the call of their kind, a chorus would begin some distance ahead, cease abruptly with our intrusion, and begin again when we had passed. The makers of forest sounds were usually hidden, either by their resemblance to the broken patterns of light and shade or by the vegetation itself, which limited vision to 50 feet in any direction. Muted and distant, the low "hut, hut, hut" of the Massena Trogon drifted downward from some hidden retreat where the vocalist perched in solemn immobility. Less secretive, the Brown and White Jays hurled their rasping and impudent insults at us as we passed on our way.

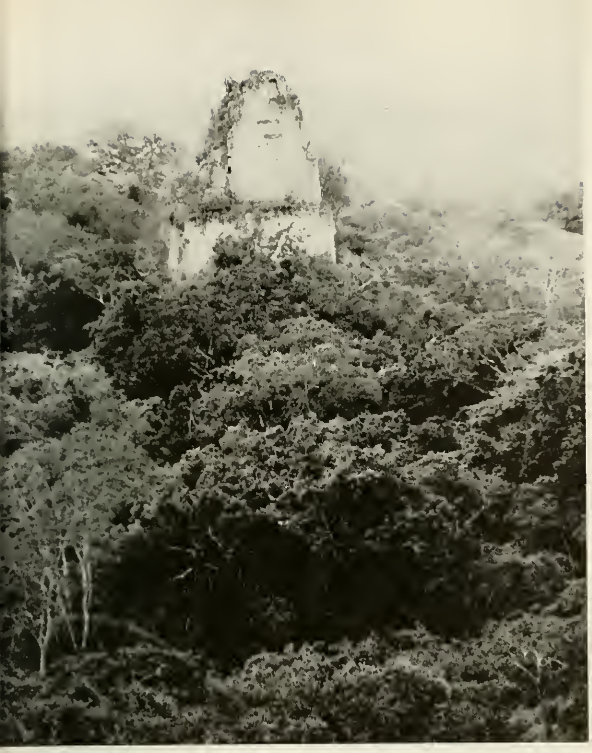
▲ **Part of the village** of Uaxactun, with the bush rising behind. The airstrip lies just this side of the nearest houses

Now and then Gregorio stopped, waiting to point out a spot in the welter of vines and foliage overhead where his keen eyes had picked out the resting form of *Mico*, the Spider Monkey, a great sulfur-breasted toucan, or a momentarily silent conclave of Amazon parrots. As often as not, it was impossible for us to resolve these half-hidden shapes until some chance movement proclaimed their presence.

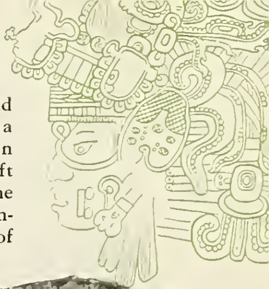
The topography of the Petén, though quite flat from the air, actually undulates in a series of low hillocks. Where the land is low and poorly drained, swamps, or *bajos*, occur. In the dry season, these give up their moisture, and the ground bakes to brick hardness. However, beginning normally in late May or early June, the daily afternoon rains quickly transform each *bajo* into a soupy morass. The Bajo de Uaxactun is such a place and lies squarely athwart the trail to Tikal.

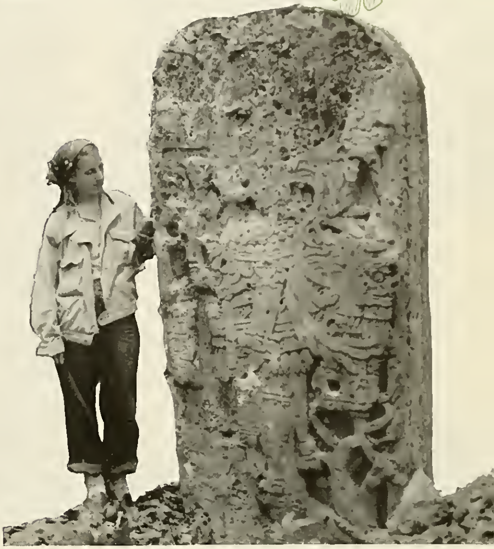
Plunging down a long slope, we quickly realized that here, indeed, the well-marked open trail ended and, with it, the opportunity for idle reflections on the beauty of the great forest. Where the ground had been comparatively free from undergrowth, a thick tangle now barred our path. The jungle floor became increasingly soggy.

The trail was clogged with mats of branches, half-fallen saplings, and prostrate forest trees. Twisted, thorn-decked vines formed a net that snagged and enmeshed our arms, legs, and clothing. Mule and rider became a single functioning machine as, for two hours, we ducked and dodged, breaking and fending our way through a seemingly endless welter of vegetation. The mule, trail-wise and strong, plunged through the oozing gray muck. Only now and then did it stumble to its knees, tripped by



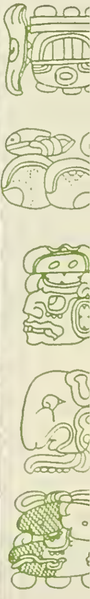
▲ At tikal, only Temple III is visible, rising out of the forests in the ceremonial heart of the city





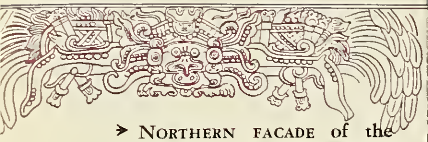
▼ **Battered** by time and weather, Stela 5 remains a monument to Maya skill in working stone. This shaft was dedicated about the middle of the eighth century. *At right,* drawing of jaguar god from Tikal

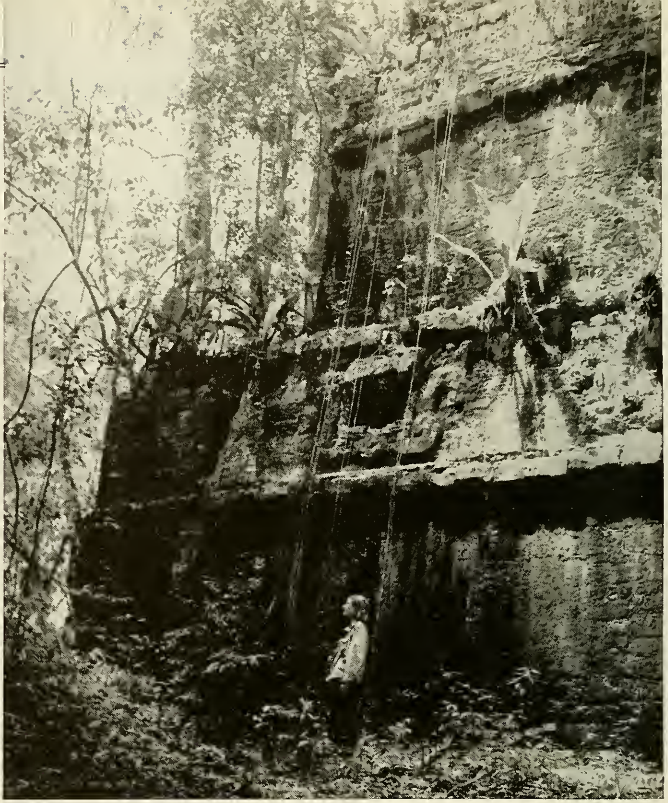
➤ **Gregorio** at the base of a ruined minor building in the central area of Tikal. *Far right:* drawings of glyphs, representing month and other period ending signs from Tikal



root or half-buried log. Sometimes up to its belly and always over its hocks in the gray molasses, it floundered on.

Only the main trails are kept open by conscious effort. The bush traveler does not attempt to clear and maintain the maze of little-used pathways that crisscross through the forests. Gregorio's machete came into play only when sheer force failed to open up the passage. The forest pays little heed to the casual intrusion of travelers straying from the main way, and any damage is quickly repaired. If any trail or clearing is neglected for so much as half a year, the rapid job of reclamation soon obliterates any evidence that man once disrupted the pattern.





➤ NORTHERN FACADE of the Temple of the Five Stories. Even in late morning, the sun penetrates only in scattered patches. *Above:* Moan bird above celestial dragon

In the midst of our crossing of the swamp, the afternoon rain arrived. Hard-driving sheets cut down through the treetops as I reached to free my poncho from its place behind the saddle. By the time I had pulled it over my head, groping blindly for potential obstacles as the mule pursued its wild progress, I was as wet as Gregorio, who had not bothered with this frantic effort to conserve a vestige of comfort. The downpour did not last long, but the rain was sufficient to set every branch and leaflet to dripping for the rest of the day.

Almost as abruptly as we had entered the swamp, we mounted a rise to find ourselves again on solid ground. The trail was still tangled with two years of uncleared growth, but the thick, clinging mud lay behind us. After several hours more of plodding progress, a sizable wall appeared beside the trail.

It was scarcely more a wall than others we had passed, for it was much in disrepair, half buried in the soil to which its substance was returning. Near by a great mound rose out of the bush, its summit nearly hidden among the tops of the trees that grew from its sides. Through the fluttering leaves, far up against the deep blue of the late afternoon sky, could be glimpsed the flat, smooth face of a roof comb. With the pleasing sense of relief at journey's end, we realized that the towering mass of rubble before us was one of the temple-pyramids of Tikal.

So dense was the bush and so completely did it mask the deserted site that, had our wanderings led us a quarter of a mile to either side, we might easily have passed the city unaware of its presence. Almost unwittingly we had arrived in the ceremonial heart of a city that may once have boasted a population in the tens of thousands. It is probably the largest prehistoric ruin in Central America.

Here was the thrill of discovery, and we would easily imagine ourselves the first visitors. The busy hand of tropical nature had erased every apparent sign that inquisitive man had been there since the original inhabitants abandoned its courts and palaces to the wilderness more than 1000 years before.

If the emotions of discovery were ours, the fact was not, for a chronological listing of our predecessors would take us back fully 250 years. Early in 1696, a Spanish priest by the name of Andres de Avendaño started north from the eastern end of Lake Petén on the long return trip to Mérida in Yucatán. He had carried his mission with some success among the Itzá Maya who resided in the island city of Tayasal and in villages about the lake shore. Centuries earlier, this people had drifted back to the land of their forefathers, after abandoning the city of Chichen Itzá just as their more ancient kin had abandoned Tikal.

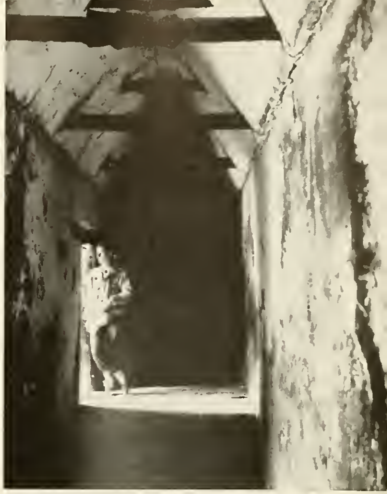
In order to avoid difficulties with unfriendly elements among the Itzá, Avendaño chose a roundabout route for his return journey. Thus, he and his party soon became lost in the unfamiliar, broken territory northeast of the lake. With diminished and finally exhausted supplies of food and water, their suffering increased until part of the group left the weakened priest, to search for help. It was during his subsequent wanderings that Father Avendaño stumbled on the site of a large unknown city lying in ruins. A reconstruction of the probable course of his travels places him at Tikal, because no other city of comparable size is known in that general area. The fortunate circumstance of his rescue, soon afterward, allowed the priest to return eventually to Mérida, where he penned the account on which credit for the discovery rests.

Tikal waited a century and a half before receiving a second visit and, with it, a name. Almost without exception, the original names of the ancient Maya cultural centers have failed to survive, so great has been the time gap between abandonment and rediscovery. In 1848, the Governor of Petén, Ambrosio Tut, accompanied by Modesto Mendez, corregidor of the same territory, traveled northward from the great lake to investigate stories told by the Indians describing a large group of ruins buried in the jungle. It is from about this time that the name of the site has come. Explanations as to its meaning vary, but the general trend of qualified thought is that Tikal means "place where spirit voices are heard," since folklore records that on festive occasions the ancient inhabitants reappear to wander the ruins of their city. It is easy to understand how the lonely desolation and deep gloom of the forest might well have fostered such a belief.

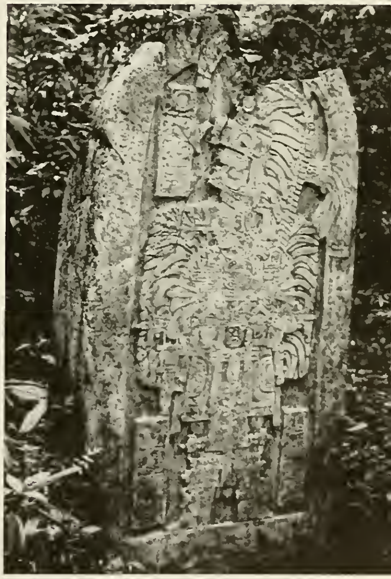
With the sudden awakening of interest in Central American antiquities occasioned by the writings of John Lloyd Stephens and the drawings of Frederick Catherwood, other travelers began probing about in the Maya area. During the last half of the nineteenth century, Gustave Bernoulli reached Tikal. Through his efforts several of the magnificiently carved roof beams from Temple IV reached Europe to find a permanent haven in the Museum at Basle, safe from hungry termites and the campfires of wandering *chicleros*. The explorations of the distinguished archaeologist Sir Alfred Maudslay and of Teobert Maler, who followed him, provided the technical descriptions of the site which, with the epigraphic studies of Sylvanus Morley, still constitute the most important scientific work ever done there.

In spite of these investigations, Tikal remains an archaeological *pièce de résistance*, awaiting the monstrous job of exhaustive excavation and study. Although parts of the site have been cleared several times, allowing photographs to be taken of the principle structures, the bush has returned each time, and we found the entire city in what seemed to be an essentially untouched state.

The main parts of the city, its ceremonial core, fill an area of nearly a square mile, while its environs extend outward for several miles. The center of the city is cut by several deep ravines, which divide it into eight recognizable precincts. The latter are connected by stone causeways, the

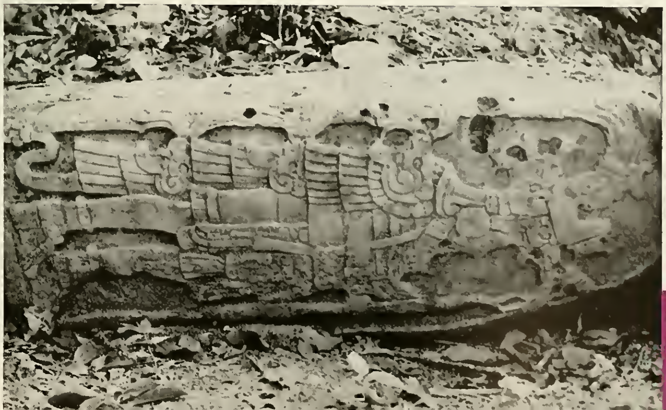


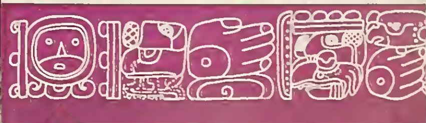
▲ **Interior** of a chamber in the Temple of the Five Stories. The beams spanning the Maya corbeled arch are of sapodilla wood—the tree from which chicle for chewing gum is procured



▲ **Stela** 16 was dedicated early in the eighth century of the Christian Era. In spite of its 1200-year history this monument still stands, its detail crisp and clear. It is a fine example of Old Empire sculpture

▼ **Stela** 9 bears the earliest date on any such monument at Tikal—about A.D. 475, though several other markers may be older. This shaft, like so many others, has either fallen or been overthrown and now lies among the debris of the forest floor near the Great Plaza





longest extending for more than a third of a mile and still serving as the easiest means of getting about.

The Great Plaza is bounded, east and west, by Temples I and II, pyramids of nearly equal size and each rising about 150 feet above base level. Built in the classical style of the Old Empire, nearly 1200 years ago, they rise in several steeply pitched layers, ascended by a stone stairway and surmounted by a wide platform. This four-sided mass, termed the substructure, contributes much to the imposing height of the temple itself, which is set back on the highest level. Most of these temples have a single deep, thickly walled room divided into several chambers. A tall ornamental roof comb carries the form of the whole structure to its noble proportions. The height of Temples I and II is exceeded by three other similarly built pyramid-temples, and these alone mark the presence of Tikal from the air, towering, as they do, above the general forest level.

We found the temple guardians of the Great Plaza well covered with brush and fair-sized trees. The roots and trunks of the latter served as a safer means of climbing the precipitous slopes than the crumbling stairways. Only the almost perpendicularly faced roof combs were relatively free of vegetation, but even they supported a minor garden of air plants, bushes, and orchids.

Above the Great Plaza and just south of it are a complex group of buildings, including the Temple of the Five Stories. Simply ornamented beams of iron-hard sapodilla wood span the steeply sloped ceilings of some of its rooms. The meeting of these pitched roofs forms a corbeled arch peculiar to Maya architecture. Some of the rooms are so dry and open that they have been used by past visitors as sleeping quarters. Multitudinous flocks of bats also find them greatly to their liking, while numerous other small creatures seek a haven in the many cracks and nooks of the disintegrating buildings. Looking out over the yawning South Ravine, the southern tier of rooms presents an impressive view of the looming bulk of Temple V, beyond.

Also near the Great Plaza, lying in a scattered assemblage, are a group of stone datemarkers or stelae. The Mayas erected these monuments at specified intervals, inscribing them with astronomical and chronological data appropriate to the time of their erection. Aside from giving a clue to the age of the city itself, they attest to the amount of cultural activity in progress throughout its history. The earliest stela that has been certainly deciphered was dedicated at Tikal about 400 years after the opening of the Christian Era. At that remote date the Mayan calendric system had already been brought to perfection, an exactness not only superior to that achieved by the ancient Egyptians but to our own present-day system as well. How many patient years of astronomical observation and recording preceded this tremendous intellectual accomplishment can only be imagined, but it is certain that the Mayas had long been traveling the ways of civilization before they erected their first lasting monuments in stone.

Although the calendric system itself needed little further embellishment, the skill of the Maya sculptors in handling stone gained a greater finesse as they reached their Golden Age. Monuments were erected with greater frequency and in an increasing number of towns and cities as their culture spread and flourished. Most of the stelae produced at Tikal are flat, tombstone-like slabs, quite unlike the deeply worked shafts that were erected at Copán and Quirigua at about the same time. The last monument dedicated at Tikal bears a date 400 years or more after the first. This span covers the greater part of the history of the Old Empire. The site is not only probably the oldest but was occupied until the final period of disintegration, when the creative fire of the Mayas flickered and finally died. The causes of this decay, in the south, remain something of a mystery. The old sites were gradually abandoned, and the people moved northward toward the outer parts of the Peninsula. The renaissance that took place in Yucatán never quite matched the first great period of splendor.

Almost alone, some distance west of the main group of ruins about the Great Plaza, is Temple IV. Towering more than 200 feet above base level, this imposing structure is the tallest building ever erected by the Mayas. The broad unbroken view that opens before the doorway of the temple, high above the forest floor, shows a vast sweep of primeval forest stretching away in receding waves to the distant horizon. Close by, the four lesser pyramids peep out above the bush, their roof combs shining bare and white in the sunlight.

Once, from this same spot, it must have been possible to look out over a living city, over a countryside patterned by vast fields of corn, broken by the roads that led in to the city. On market days or at times that had been marked out among them as holy, the people who tilled the fields and lived in hamlets and villages about the great city bore the produce of an agricultural nation to the market places and ceremonial centers.

Today, in villages in the highlands of Guatemala and in Yucatán, the Indians still meet in the market places to barter and exchange news as they and their forefathers have done for two millennia. They still speak tongues that are called Maya, and among them we may see faces startlingly like those on sculptured remains in the old cities. They remain a proud people clinging in many ways to old traditions, but even they have lost contact with a past as distant as that of Tikal. The noble men whose likenesses remain crisp and fresh on the ancient stelae are indeed gone. The ancient Mayas are gone.

A solution to some of our desert dilemmas is offered in an ancient tree that can arrest soil erosion and at the same time yield a financial profit

Carob—TREE OF MANY TALENTS

By Ruth H. Dudley

All photographs by the author

FOR years the familiar carob *(Ceratonia siliqua)* has played an important part in California. But not nearly important enough, say interested scientific agriculturists.

Used mainly as a lawn or parkway tree, with its beauty and hardiness taken for granted, this sturdy member of the bean or legume family has thrived through the years, often under complete neglect. But now things are looking up for the carob. This indomitable tree is about to come into its own.

It all started when Dr. Walter Rittenhouse, of San Diego, was looking into the possibilities of conserving the soil by growing more food and feed on trees and less in annual crops. The carob tree seemed a perfect answer. Had it not for centuries served the people in its native Mediterranean land? And weren't growing conditions there quite similar to those in our own semiarid Southwest?

Indeed, its interesting history certainly would indicate that the carob has infinite possibilities. For

➤ THE HARDY CAROB makes a beautiful street tree in southern California, where it even seems to thrive on neglect centuries many a domestic animal has fed and flourished on the very nutritious pods (40 per cent sugar and 6 per cent protein). Indeed, they have been utilized so consistently by swine that they are often called "swine's bread." And according to the Bible parable, "the husks which the swine did eat" and which saved the Prodigal Son from starvation were these same carob pods.

Known also as the locust tree, its pods are believed to have sustained John the Baptist while in the desert. And, more recently, people in other countries have subsisted on them in hard times and famine.

Even Californians, back in 1922, became sufficiently aware of the wonderful properties of the carob bean to make some attempt to utilize it. Quite tasty carob bread was made and sold, as was carob syrup, breakfast foods, dog biscuit, calf meal, etc.

Later, chemists discovered a vegetable gum in the carob seed, which has been used in many products. Carob gum, or tragasol, as it is called, has been used in foods, cosmetics, inks, detergents, and insecticides, and it has many more potential uses. Almost all this, however, was developed from the imported carob, no proper research having been made on the possibilities of growing our own carob orchards and expanding into a large-scale industry.

Small wonder, then, that a tree with such an interesting history and wide possibilities should appeal to Dr. Rittenhouse. Why not produce this carob gum here, for instance, send the valuable leftover food elements to our local feed mills—and at the same time conserve our soil? It did, indeed, seem the answer—a financially attractive method of controlling soil erosion.

So in March, 1949, funds were provided by Dr. Rittenhouse, and a four-acre demonstration orchard was started near Vista, California. In his book, *Carob Culture in the Semi-arid Southwest,* Dr. J. Eliot

▲ CAROB PODS AND FOLIAGE. Travelers in the Near East may have seen these pods offered in local markets—the fruit that is supposed to have sustained John the Baptist in the desert

◄ THE CAROB can stand quite severe pruning and is therefore often used to give special effects on the lawn or parkway

Coit tells about this interesting experiment.

Here, in this representative acreage of erosion-ridden dry land, a fine orchard of carob trees has been set out for study. Planning for a 30-year period, interested agriculturists and soil conservationists, through the co-operation of the U. S. Department of Agriculture and the University of California, hope to learn many things about the possibilities of the carob under proper cultivation. They believe, for instance, that this tree is capable of producing at least twice as many units of cattle feed as barley or hay and at lower annual cost per acre. The experimental orchard will give them a chance to prove it, to check actual tonnage per acre.

Budwood of the best varieties of carob has been secured from Tunis, Greece, Cyprus, and Italy and is being tried out. Five varieties are already well established in thirteen representative trees. And some of our California varieties are being studied, too. The Bolser, especially, seems to have fine possibilities when properly cared for, as do the Horne and Nichols.

In his later pamphlet, "Carob or St. John's Bread," Dr. Coit tells us that under favorable dry-farmed conditions, the carob should start bearing the fifth year after budding. The average yield, he says, should begin at around five pounds per tree, increasing to around a hundred pounds by the twelfth year and as much as two hundred fifty pounds by the twenty-fifth year, or when the tree is full grown.

At this rate, Dr. Coit points out, and with trees planted 35 to the acre, the expected yield of 8750 pounds (a conservative estimate) would be much greater than one could get from barley or hay under like conditions.

Gophers like the carob roots and seem to be the most destructive pest. Presumably they would have to be exterminated where plantings were made. Also, since cattle like the carob foliage, these animals should not be pastured in an orchard until the trees are larger and their bearing branches out of reach.

The carob is evergreen and extremely drought resistant. Since most varieties are dioecious, it is recommended that one male (nonbearing) tree be planted to every 25 or 30 female trees—unless, of course, the Bolser, Horne, or Sante Fe varieties are being used. These have an abundance of both pollen and female flowers on each tree. In Europe, it is customary to graft male limbs into the tops of a few properly spaced females.

It is hoped that other agriculturists in the semiarid Southwest will become interested enough to set up carob orchards. The initial cost and the nonprofit interim until the trees are of bearing age seem to be the chief drawbacks. However, this cost, as well as subsequent operating expenses, are tax deductible. Further, in the interest of soil conservation, the U. S. Government will now give help (monetary and supervisory) to landowners who will work with plans approved by district engineers.

It is hoped that this, coupled with the bright prospects of future gain from both feed for livestock and manufactured products, will tempt enough landowners to develop our common carob into something very, very special in our dryland agricultural economy.

Incidentally, information and budwood, says Dr. Rittenhouse, will be furnished gladly. His address is 4575 - 58th Street, San Diego 5, California. Or interested parties may secure further details from Dr. J. Eliot Coit, 690 Oceanview Drive, Vista, California.

▼ PART of the four-acre demonstration orchard near Vista, California. Here it is hoped that many things will be learned about the potentialities of the carob—the "St. John's Bread" of the Bible—under cultivation over an extended period

CAROB
DEMONSTRATION
ORCHARD

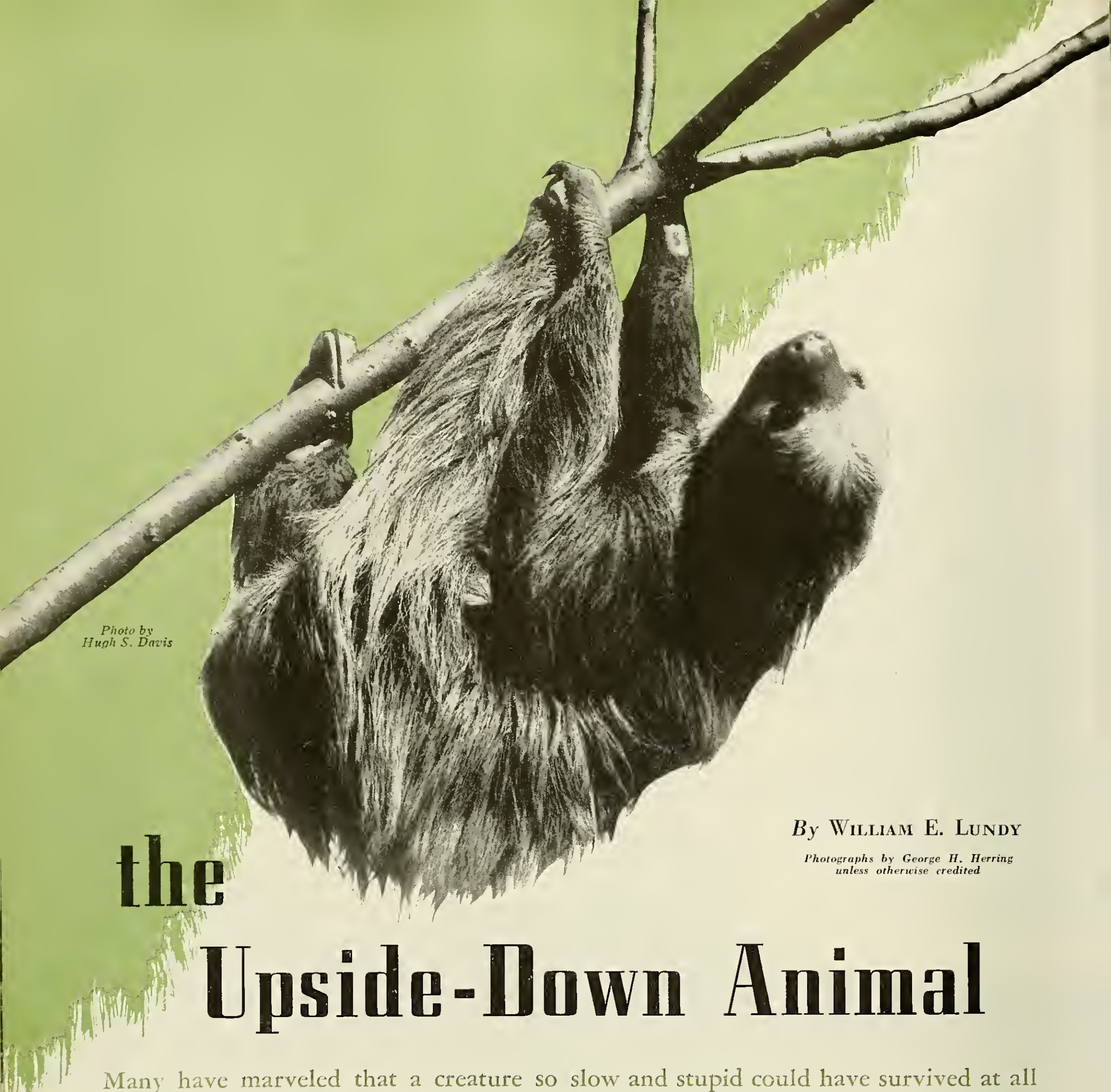


Photo by Hugh S. Davis

the Upside-Down Animal

By William E. Lundy

Photographs by George H. Herring unless otherwise credited

Many have marveled that a creature so slow and stupid could have survived at all

TWO weeks in the tropics was far too short a time to prepare my bride for the sight of the first "pet" I brought to her while we were living on the Panama-Costa Rica border. Standing some feet away, she gazed in astonishment at a sloth with long brownish-gray hair, which was hanging upside down from the seat of my railroad scooter.

An area of short, orange-colored hair on its back, encircling a black stripe along the spine—the so-called saddle mark—indicated that it was a male of the Three-toed species, so named because of the three claws on each of its feet.

The sloth's eight- or nine-pound body, with long forelimbs and short hind limbs, was suspended by twelve curved claws, three inches long, which held with a viselike grip. The claws seemed to grow from its ankles, for the soles of its feet were completely covered with long hair.

A mere stub of a tail and almost no semblance of a head made its long neck look longer, while the face appeared as only a splotch near the end. Small dull eyes, utterly devoid of expression, a small nose, and only a slit for a mouth combined to form the most idiotic face to be found on a mammal. Swaying slowly back and forth on the much-too-long neck, the eyes stared vacantly at nothing, while a hissing sound came almost continuously from its mouth.

My wife's look of astonishment

turned to revulsion when she saw what appeared to be parasitic flies, disturbed by my handling of the sloth, working their way back into the long, coarse hair. As a seasick look played around her mouth, I realized that the joke had been carried far enough.

With a neighbor's help—for it is more than a one-man job—I pried loose the long claws and placed the sloth on the ground near a tree.

A sloth on the ground is a pitiful sight. Its shoulders appear to be out of joint, for the limbs cannot support the weight of the body when the animal tries to walk as other four-footed mammals do. It is forced to drag itself along, belly scraping the ground.

When it reached the tree, the sloth began to climb slowly. Reaching a limb, the creature advanced along it, body hanging underneath, suspended by the long claws of all four feet. So slowly did it take each step, so deliberately did it place each set of claws over the limb, that one would have thought it was stalking something rather than traveling its natural highway back to the jungle and freedom. There, the contrast was remarkable. Gone was the crippled appearance; though still very slow, the sloth was now master of its movements.

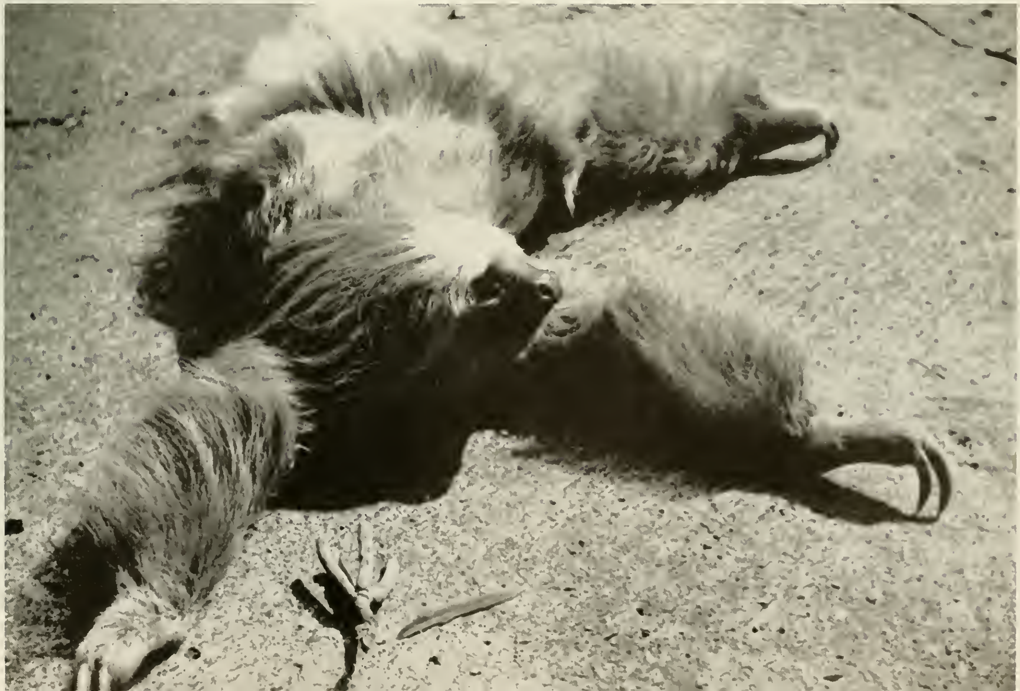
So strange is the appearance of these animals and so unique their habit of walking upside down through the treetops that explorers and naturalists have, over a period of four centuries, written reams of fiction about them. Fortunately, a number of scientists also have been interested in these strangely aberrant mammals. Three, George B. Wislocki, Curt P. Richter, and Robert K. Enders spent months on Barro Colorado Island, in the Canal Zone, studying large numbers of sloths, and they have recorded many interesting facts. Yet no description, including my own, can give an adequate picture of the sloths in their native haunts.

Some local residents are unaware that another species, the Two-toed (*Choloepus hoffmanni* Peters), is not uncommon here, though possibly outnumbered five to one by the Three-toed (*Bradypus griseus griseus* Gray). Too many authors have seen specimens of only one species and in writing their impressions have used the general term "sloth." One who knows only a single species would consider a description of the other grossly inaccurate.

From a distance, you might easily mistake one kind for the other. At close range, however, many differences in looks and actions will be quickly noticed.

In sharp contrast to my wife's "pet," the Two-toed Sloth's face *does* show animation when disturbed, and its normal-sized eyes *will* focus on its enemies. A large bare nose, ending in wide nostrils, covers a mouth that is quite large when opened. It has no tail, no hair on the soles of its feet, and only two claws on its front feet. The limbs are of almost equal length.

∀ ON THE GROUND, the sloth is a crippled caricature of himself. "Had I taken a description of him as he lay sprawling on the floor," wrote C. Waterton, "I would have misled the world and injured natural history"



While sleeping, rolled into balls with their necks tucked in between the forelimbs, sloths look more like inanimate objects than living animals. The Three-toed, squatting in a crotch, looks like a termite- or wasp-nest. The Two-toed, suspended among vines, becomes a half-hidden bird's nest or just a bunch of dried leaves.

During the dry season, when foliage is less dense, I vie with my wife in "spotting" sloths along the old Chiva-Chiva Road, some ten miles from Panama City. Once when she saw one, I contended that it was a termite nest until she announced triumphantly, "There, your termite nest is scratching its side!"

To Margorie Allee, one looked like "a dirty, shaggy doormat." A visitor from the States once asked, "What is that old mophead doing in the crotch of that tree?" I once climbed to investigate a bird's nest—only to have it produce arms and legs and move slowly away through the vines. Yes, many people have seen sloths without knowing it.

▲ To capture a Three-toed Sloth is only a matter of grasping it in the arm pits and loosening all four feet at one time. This specimen was still wet from a heavy rain

Because he and his men had never seen sloths eat anything, Oviedo, the first chronicler of the Indies, wrote in 1535, "I could never perceive but that they live only of air." This idea must have been short-lived, for the sloth is a notorious glutton.

The Three-toed lives almost exclusively on leaves of the Cecropia tree, locally known as *Guaruma*. This is the principal food of the Two-toed also, though in captivity it will eat bananas and various vegetables.

A Three-toed Sloth may be handled with safety by grasping it from behind in the armpits. Its efforts at self-defense, to quote Dr. Beebe, can be circumvented by any creature except another sloth. The lethargy of this species, attributed by many writers to sloths in general, is far from true of the Two-toed. One that I captured recently struck out furiously whenever I came near. Their sharp, sickle-like claws can inflict serious wounds.

A bit of Spanish humor is shown in the account of the sloth written by Oviedo. He says, "The sloth is one of the slowest beasts in the world, and . . . can scarcely go fifty paces in a whole day." He then tells that they nicknamed it Perico Ligero ("Nimble Peter"), a name still used by many of the natives today. Others call it Perezoso ("Lazy").

Sloths are so slow in their movements when undisturbed that there is no need to exaggerate, yet many writers have done so. Dampier told that before they could come down from one tree and climb another, they were skin and bones, though they were fat when they started, and that it took eight or nine minutes for them to move one leg forward three inches. Dr. Beebe claims that "In action, the second hand of a watch often covers more distance."

When approaching the trunk of a tree, suspended beneath a horizontal limb, a Three-toed Sloth must do a rightabout-face in order to descend, for unlike Dracula, it backs down. Only a movie could adequately describe the process. Holding with the forefeet, the animal unhooks the hind feet; and the rear end, still on a level with the head, describes a half circle very, very slowly. The sloth then proceeds backward down the trunk.

I have never witnessed a fight between sloths in the wild, nor have I heard of such an encounter. It is well known, however, that placing two females in a cage together will often start a fight, which may end in death if they are not separated. Wounds are inflicted both with teeth and claws.

The Two-toed Sloth that I captured would repeatedly snatch a stick with which it was touched and bite it savagely with the canine teeth. Yet sloths have been classified under the order Edentata—or toothless!—and Oviedo said, "They bite not, nor can they bite, having very little mouths."

An incredible thing about the sloths is their ability to swim. These creatures, which have become so highly specialized for aboreal life that their feet are reduced to mere hooks for grasping, would seem to be the least likely to have this art. That sloths *can* swim has been known for nearly a century, for it was mentioned by Henry Bates in his *Naturalist on the River Amazons*. Others tell of sloths swimming rivers a mile or more in width.

Dr. Beebe called the sloth a "languidly loving creature," because two courtships he watched in Guiana resulted, as he put it, in nothing more serious than his own amusement. Perhaps the sloths of the Canal Zone take their love-making more seriously, for one love affair witnessed by Dr. Robert Enders lasted "from time to time over a period of two days"—and might have continued for an even longer period but for the accidental death of the "swain." Furthermore, he states that in a group of sloths that he bought, the "females . . . either had babies with them or were pregnant or both."

Baby sloths are born singly. These small balls of hair cling to the mother's chest, their tiny claws entwined in her long, coarse hair. In this way they are carried about until they are able to shift for themselves.

The Three-toed Sloth's defense of its young is little more effective than its self-defense—a slow swinging sweep of the forearms. When separated from her baby, the mother Three-toed apparently soon forgets it and goes about her business undisturbed. This is not so with the Two-toed mother, which fights viciously to protect the young. Some claim that she will destroy the baby rather than have it taken from her. Perhaps this does not occur intentionally but as a result of her savage efforts to defend it.

ACCOUNTS of the creature's lethargy are sometimes exaggerated, but all agree that the creature moves by s-l-o-w motion. The Three-toed Sloth shown here is beginning his unhurried journey back to the jungle and freedom

During the rainy season, when the jungle is greenest, multitudes of tiny green algae grow on the hair of the Three-toed Sloth, giving it a green sheen which makes the creature less conspicuous in the trees. Here, then, is a vegetable parasite that is of direct benefit to its animal host. Indeed, we should not call the alga a parasite but a partner.

Small moths are often found in large numbers in the hair of our sloths. It was some of these that my wife mistook for parasitic flies on her "pet." They have been observed to take moisture from the eyes and nostrils of a Two-toed captive. Local entomologists have combed the hair of many moth-infested sloths, searching in vain for the larvae, which have apparently not yet been recognized locally.

Almost unbelievable are some of the stories told of the tenacity with which these lowly mammals cling to life—recovery after suppression of respiration for 30 minutes by ether, recovery after 40 minutes of immersion in water, and survival for 30 hours after decerebration. "Of all animals," wrote Charles Waterton, "not even the toad or tortoise excepted, this poor ill-formed creature is the most tenacious of life. It exists long after it has received wounds which would have destroyed any other animal; and it may be said, on seeing a mortally wounded sloth, that life disputes with death every inch of flesh in its body. . . . I saw the heart of one beat for half an hour after it was taken out of the body." He told, however, that one sloth died in ten minutes, apparently without pain, after having been shot in a leg with an arrow that had been dipped in "Wourali" poison, a concoction made by the Indians of South America.

If records meant anything to a sloth, this strange creature could boast of at least two. Of all mammals, it has the highest number of neck vertebrae, varying from six to nine instead of the usual seven*. It also has the lowest and most variable body temperature. From a low of 75 degrees F., it ranges to as high as 91 degrees. Even its "normal" temperature fluctuates between 85 and 91 degrees, according to Dr. Curt P. Richter.

It would have been strange indeed had no myths developed around a creature so weird in appearance and so unique in habits.

The lassitude of the sloth was believed by the early Spaniards to be due to heart trouble, which they thought the animal attempted to cure by scratching over the heart with the claws of the left hand, ". . . and thus the claw is the approved remedy against this evil."

According to one of the Spanish friars, "He who eats of the flesh of the perico ligero dies of it; because it is so phlegmatic." This myth may have influenced the natives of this section, for I have never heard of them eating one of these animals. This belief has probably helped considerably to ensure their survival in fair numbers in the Canal Zone. When the Indians of the Darien region of Panama saw one being prepared for Dr. Thomas Barbour's supper, they told him that the flesh of the sloth was unfit for food. It is well known, however, that many of the Indians of South America consider it a delicacy.

The Three-toed Sloth has been given credit for making a noise that belongs to another creature. I refer to a jungle voice that is so expressive of human sorrow that it has often been mistaken for a woman calling in hopeless grief. The myth that the sloth is the author of this cry has been prevalent for over four centuries; but we now know that it is made by a night-bird of the goatsucker group (*Nyctibius griseus*)†.

Another myth, which comes from Dutch Guiana, is that one may not shoot a sloth, for should he

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* Even the giraffe has only seven vertebrae in the neck. The only exceptions among mammals are the manatees, which have six, and the sloths, which have six, eight, or nine. In certain whales, the majority of porpoises, and some rodents, the neck bones are more or less united, and in the Right Whale they form a single bony mass. Some horses also do not invariably have seven, especially the Arabian horse.

† See "Poor-me-One," by William E. Lundy, NATURAL HISTORY, March, 1951.

▲ THE THREE-TOED'S efforts at defense can be avoided, to quote William Beebe, by anything but another sloth

➤ THIS TWO-TOED snatched a stick and bit it savagely

▲ THERE IS NO LETHARGY in the Two-toed Sloth's defense. This one lunged at the author with remarkable speed

do so, his gun would be ruined.

Many who have seen the ungainly Three-toed Sloths in our Canal Zone jungles are surprised that there *is* such an animal today. Remembering all that they have heard of the constant struggle for existence and the theory of the survival of the fittest, they marvel that a creature so slow, so stupid, and seemingly so unfit to cope with the many predators of a tropical jungle could have survived. Yet survive it has, while the mighty ground sloths which once inhabited this area are known only by fossil remains.

Probably its survival is due to a combination of many factors, foremost of which could well be protective coloration and its habit of feeding mostly at night and remaining motionless during most of the day. Its 23 pairs of ribs, heavy coating of fur and hair, and thick, tough skin all tend to protect the viscera from claws and talons of predators, while its extreme tenacity of life gives Nature time to repair wounds.

To those familiar with sloths in the wild, it is evident that Count de Buffon's observations were limited to animals on the ground. "The inertia of this animal," he wrote, "is not so much due to laziness as to wretchedness . . . Inactivity, stupidity, and even habitual suffering result from its strange and ill-constructed conformation . . . Its only safety is in flight . . . Everything about it . . . proclaims it to be one of those defective monsters, those imperfect sketches . . . which, having scarcely the faculty of existence, could only continue for a short time . . . They are the last possible term amongst creatures of the flesh and blood, and any further defect would have made their existence impossible."

At the other extreme we have the statement of Major R. W. Hinkston that "No animal is better adapted than the sloth to a life in this virgin forest."

Perhaps their extreme specialization for life in the jungles will eventually work their downfall, for man is fast encroaching on the tropical forests, and to the extent that he does so, the domain of the sloth shrinks.

Unless large tracts of jungle lands are set aside for the preservation of wildlife, as was done on Barro Colorado Island in the Canal Zone, not many more generations of men will see these creatures walking upside down through their habitat, for as Buffon expressed it, "They will be erased from the catalogue of living things."

Virgin

With our Southwest rapidly losi
National Monument—wi
our last hope of preserving

▲ **Organ Pipe Cactus National Monument** also contains vigorous stands of the stately Saguaro. This sentinel rises near the border of our sister republic to the south, which the Monument touches for 30 miles of its length

▲ **Montezuma's Head:** a prominent landmark seen as one approaches the

AGES before Alexander or Attila or any human conqueror was born, an invading army marched upon our Southwest. It was an army of plant life—ancestors of the present familiar desert-wise cacti and thorn vegetation of the arid lands. It advanced from Central America and the Mexican tropics along a series of great migration paths, following the north-south trend of mountains and troughs with but little deviation to the east or west.

There was no chronicler with this invasion—no poet to sing of battles won or lost. But botanists, ferreting out the story, know that it was a long struggle and a hard one.

The vegetation moved northward by evolving to meet changing conditions of soil and climate, by taking advantage of moist cycles and holding its gains when the dry years came. It is possible that the deciding factors in opening the Southwest to the cactus clan and its allies were the glacial epochs to the north, for even the desert knew longer winters and more rain when the icecap spread southward.

One plant migration path lay along the eastern coastal area of the Gulf of California. From it a side expedition of subtropical vegetation struggled up the Sonoyta river valley and came to a halt around the southern ends and outwash plains of the Ajo and Growler Mountains in southwestern Arizona. Of course, it wasn't Arizona then. Before the Gadsden Purchase in 1853 made this Sonoran desert garden a part of the United States, it was claimed successively by ancient native tribes, by the crown of Spain, and by the Republic of Mexico.

This superb arboreal desert fell within our boundaries accidentally, for the Gadsden Purchase was de-

ert Wonderland

poiled areas to civilization, Arizona's Organ Pipe
k beauty and striking variety—represents
s example of desert landscape

By Lucile *and* Harold Weight

All photographs by the authors unless otherwise specified

▲ The lovely flower of the Organ Pipe Cactus opens in the warm nights of May and June. Soon after daybreak the blossom closes again *National Park Service photo*

onument from the North. Legend says that Montezuma sent most of the Aztec reasure to be buried at its foot so that it would not fall into Cortes' hands

signed primarily to facilitate construction of a southern railroad to the Pacific. With it the United States also gained its second largest native cactus, *Cereus thurberi,* the beautiful Organ Pipe. And in 1937, the heart of the organ pipe country was withdrawn and preserved as Organ Pipe Cactus National Monument.

In 1949 Representative Harold A. Patten of Arizona introduced into Congress a bill to change the status of Organ Pipe from Monument to National Park. One of the suggested names is Desert National Park. As might have been expected, the action set ablaze an old controversy in southern Arizona. Some Arizonans will tell you that creation of the Monument was never justified, that it is far too large—328,162 acres, Arizona's biggest National Monument—and that the idea of making a National Park out of a cactus patch is outrageous. Other Arizonans insist that a Park there on the international border is just what the country needs, and the proposal has been supported by the Chambers of Commerce of Tucson, Phoenix, Yuma, Ajo, and Casa Grande.

Just what is the difference between a National Monument and a National Park? In principle, a National Park is supposed to be an area of supreme or superlative scenic, scientific, or historical importance dedicated and set apart for the benefit and enjoyment of the people. Its twin purposes are its enjoyment and use by the present generation, with its preservation, unspoiled, for the future. A National Monument may be set up to protect historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest.

In present actual practice, the only real differences are often the manner in which the reserve is created, the amount of money available for its development, and the greater prestige of the National Park. National Monuments may be proclaimed by the President of the United States under authority given in the "Act for the Preservation of American Antiquities," approved in June, 1906; but a separate Act of Congress is required for the creation of each National Park.

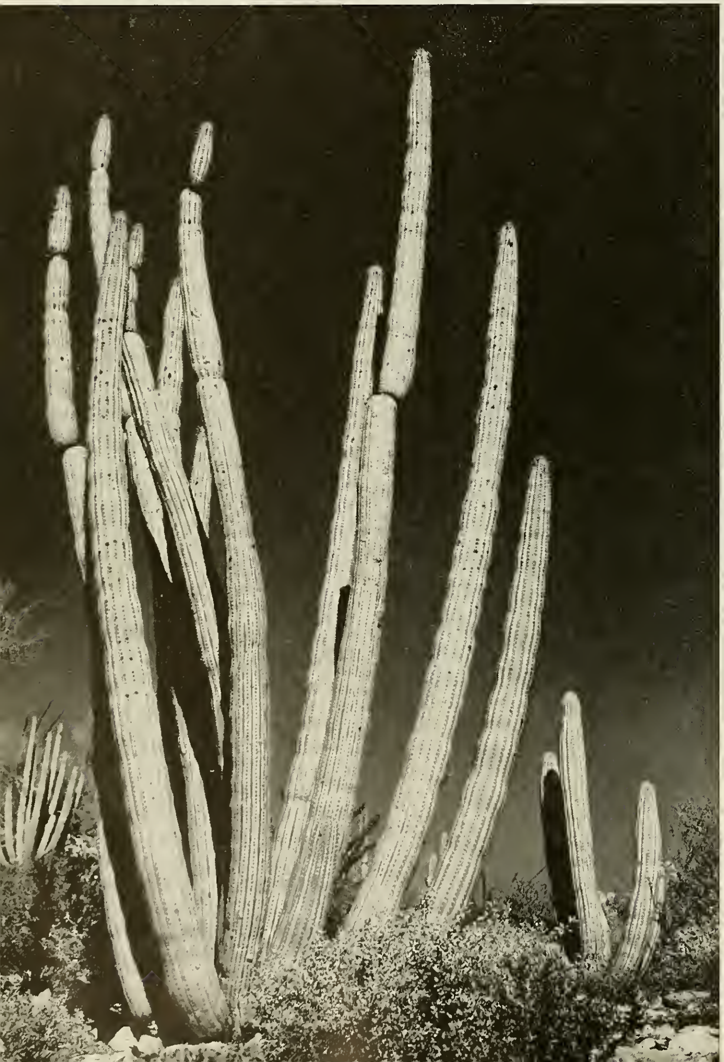
The final fate of this area may depend largely upon the support or disapproval of conservationists and nature lovers over the nation as expressed to Congress. You may therefore be interested in Organ Pipe's qualifications to join our galaxy of National Parks. Just what is so remarkable about its vegetation? How will it fulfill the National Park requirement of bringing benefit and enjoyment to the people?

Even as recently as the 1930's, when Organ Pipe Monument was being planned and established, the idea of withdrawing an area simply because it was an outstanding example of desert and desert vegetation would have been greeted with amusement and suspicion. There were seemingly endless stretches of desert and relatively few people interested in it.

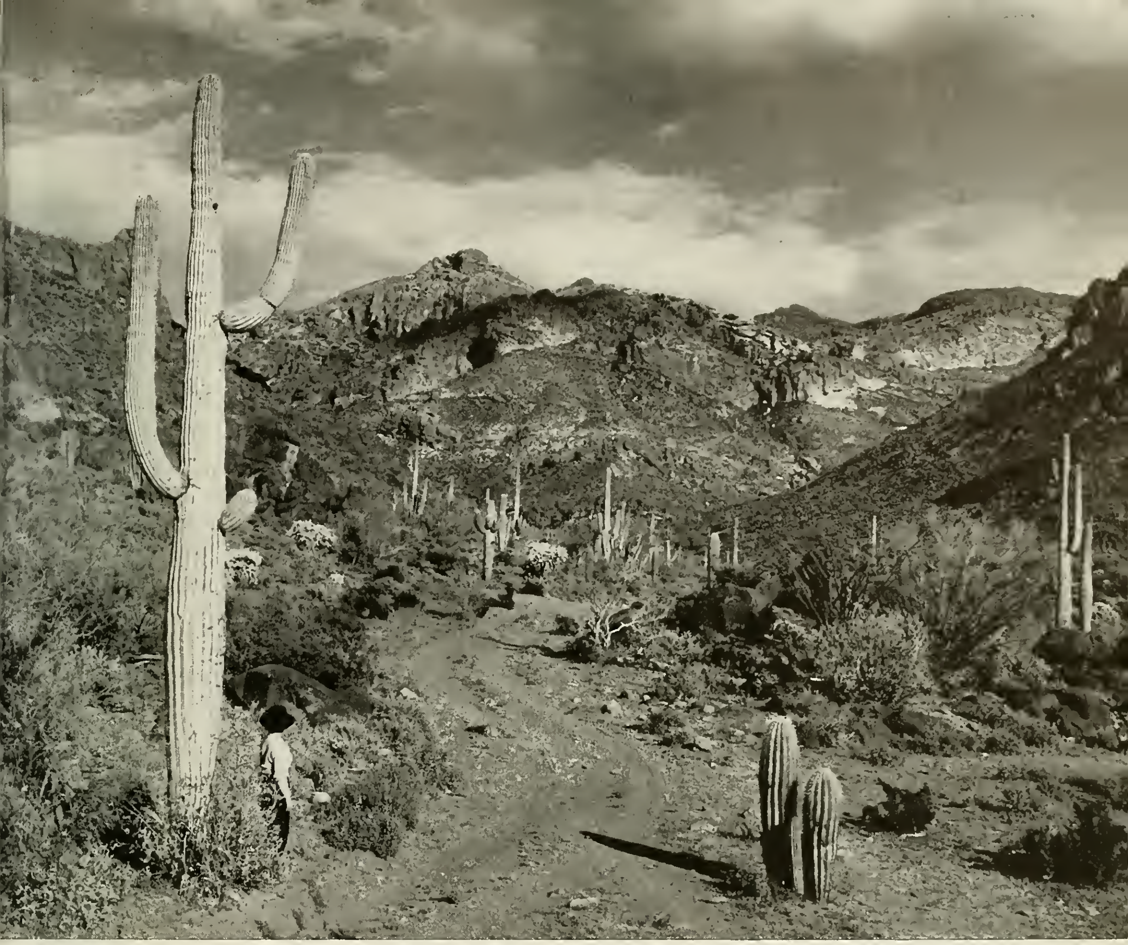
Today, thousands have moved into the heart of the desert, and other hundreds of thousands turn to it for relaxation, health, and release from the pressures of modern civilization. Government five-acre homesteads are multiplying with almost astronomical speed. Subdivisions have sprouted even on sand dunes. The Armed Services and Atomic Energy Commission swallowed vast sections during the war, and now, rather than disgorging, they seek to gobble more. The idea that all our millions of acres of desert may be closed off or nibbled out of existence is no longer fantastic.

Today the austere beauty, charm, and fascination of the desert and the wonders of its vegetation are conceded. Its great and booming popularity among all income groups is an indication of its ac-

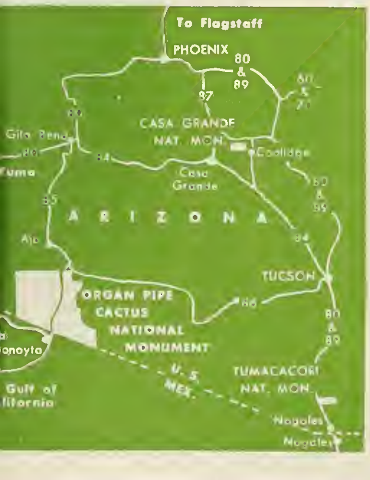
⮟ THE GRACEFUL FLUTED FIGURES of the Organ Pipe Cactus extend upward 20 feet or more and are rarely seen outside the boundaries of the Monument



⮝ SUPERINTENDENT WILLIAM R. SUPERNAUGH hopes for additional access roads, deplores fast highways or commercial developments



▲ **Alamo Canyon**, accessible part way to limited traffic, and then by foot trail, is the gateway to half-explored canyons in the Ajo Range. In early April, the desert floor is strewn with exotic flowers


To Flagstaff
PHOENIX
80 & 89
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87
80
CASA GRANDE NAT. MON.
Gila Bend
80
84
Coolidge
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Casa Grande
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A R I Z O N A
Ajo
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TUCSON
ORGAN PIPE CACTUS NATIONAL MONUMENT
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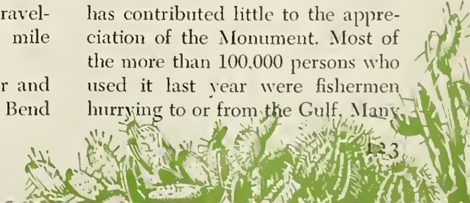
TUMACACORI NAT. MON.
Gulf of lifornia
Nogales
Nogales

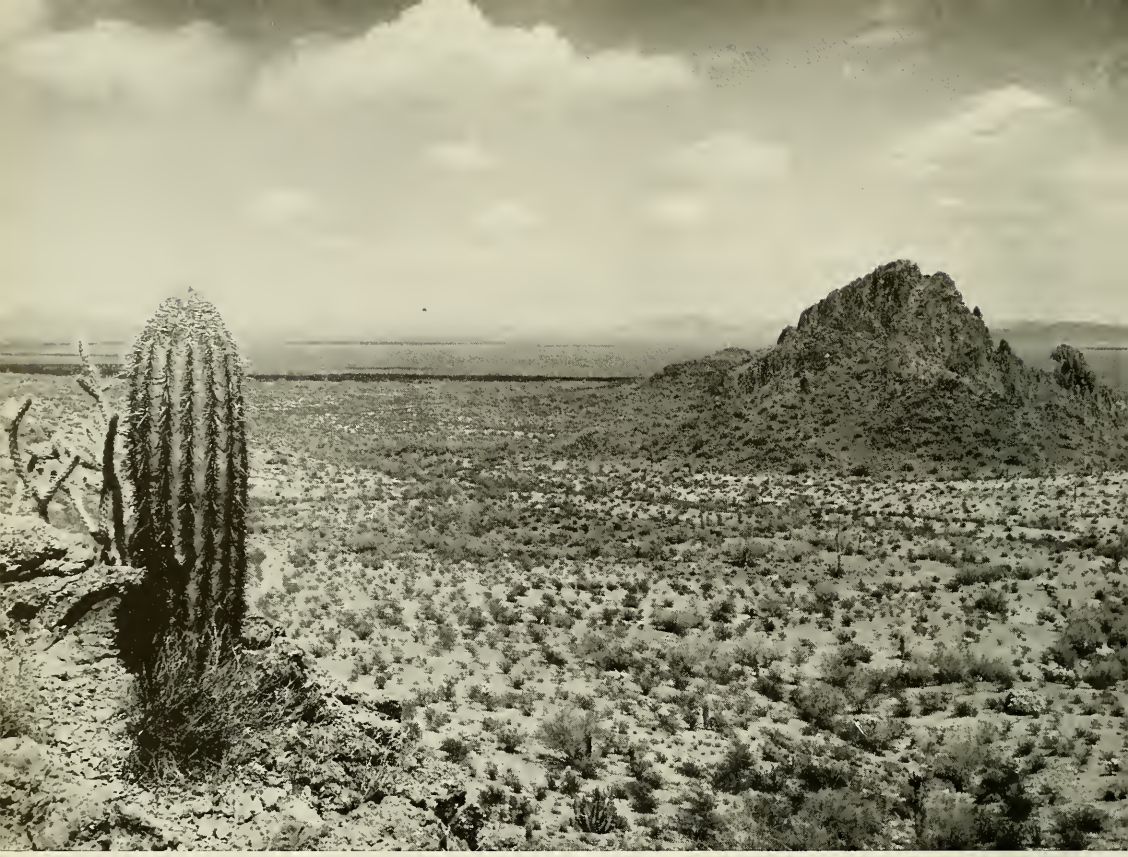
ceptance as an important part of our national heritage. Few indeed would be startled or contemptuous today at the idea of developing a Desert National Park.

But Organ Pipe Cactus National Monument is not widely known or appreciated. Undoubtedly, its name has been a great deterrent to tourist use of and interest in the region. Motorists crossing southern Arizona on Highway 80 are hardly likely to make a detour of 150 miles if the only attraction is another brand of cactus. Why, they've been traveling through the spiny stuff mile after mile!

We fell into the same error and passed the turnoff at Gila Bend many times before finally heading down. Then we found that the Monument is not simply a protected range for a rare species of cactus. We found ourselves in a desert wonderland.

The beauties and attractions of the Monument weren't displayed to us all in a day; and if we'd stuck to the paving in the Monument, we would never have seen them. That paved highway, built during the war from Ajo to Punta Penasco on the Gulf of California, has contributed little to the appreciation of the Monument. Most of the more than 100,000 persons who used it last year were fishermen hurrying to or from the Gulf. Many





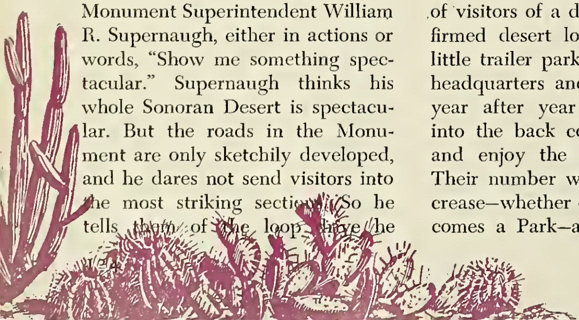
▲ An almost obliterated track near the center of the area leads across this plain toward Dripping Springs in the Puerto Blanco Mountains. Indians and prospectors once used it, as relics left by both clearly indicate

of them did not even stop at Monument Headquarters 100 yards from the highway, let alone try the side roads. And the highway itself does not touch any of the area's beauty spots or its good stands of organ pipe. Yet all these through travelers feel they have seen the National Monument. They went clear through it twice, didn't they? And if you ask them. . . .

Some of those who stop say to Monument Superintendent William R. Supernaugh, either in actions or words, "Show me something spectacular." Supernaugh thinks his whole Sonoran Desert is spectacular. But the roads in the Monument are only sketchily developed, and he dares not send visitors into the most striking sections. So he tells them of the loop drive he and his assistants have laboriously worked into the low hills by the international boundary. There they can see splendid organ pipes and the even rarer senita, as well as cholla and pencil cactus and giant saguaros as fine as those in Saguaro National Monument.

Sometimes the visitor seems disgusted when the Superintendent can't conjure up a Bryce or Zion. But there are an increasing number of visitors of a different kind—confirmed desert lovers, who fill the little trailer park and camp site at headquarters and who come back year after year to delve farther into the back country or to relax and enjoy the wilderness peace. Their number will continue to increase—whether or not the area becomes a Park—as more and more people learn about this magnificent combination of Sonoran vegetation and the beautiful and varied types of topography we have come to look upon as typically desert. Organ Pipe is rich in vivid volcanic buttes, strange stone formations, little-known canyons. Visitors can find Indian petroglyphs and old camp sites and forgotten mines.

Finding that we were really interested in learning all about his Monument, Superintendent Supernaugh told us something of its history. We learned of the pilgrimages that the Papagos have made from time immemorial, to harvest the sweet fruit of the organ pipe. More than 250 years ago, Jesuit missionaries described the Indian carnival when the *pitahaya dulce,* as the early Spanish called the organ pipe



cactus, was stripped of its red-fleshed fruit.

We heard of the paths made across this land by the exploring and proselyting Spaniards—Melchior Diaz, Eusebio Kino, Francisco Garcés, Juan Bautista de Anza, Pedro Font—explorations beginning long before the Pilgrims landed. We heard the story of early mining by Spaniards, Mexicans, and Americans—of times when the copper-silver-gold ore was transported to the Colorado River by pack train or wagons drawn by mules or oxen, then shipped by sailing vessel around the Horn to Swansea, Wales, bringing as much as $360 a ton there.

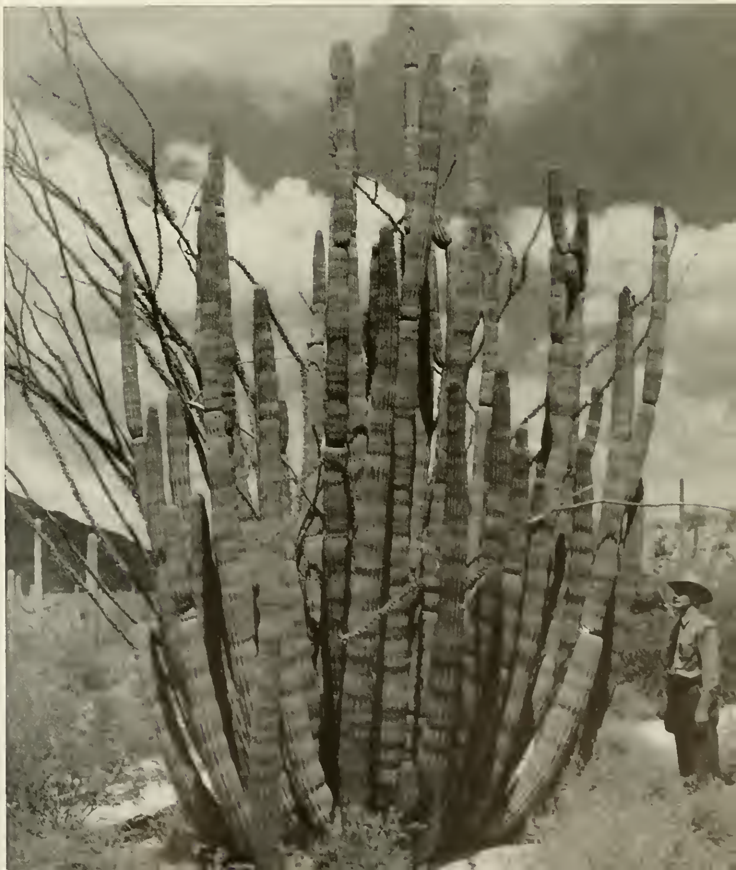
When the Superintendent learned we had a four-wheel-drive vehicle that could penetrate even along unimproved tracks, and that we were anxious to see the best of Organ Pipe, he brought out maps and photographs and gave free rein to the great enthusiasm that has won him the title of "Godfather of the Organ Pipes." As he told us of possible trips, we realized how foolish we had been in planning to "do" the Monument in a day. For the rest of the week we traveled within its boundaries—sometimes on fairly good desert roads, sometimes in compound low along the washed threads of prospectors' trails.

Favorite among the trips we have made is that along the border to Quitovaquito, in the southwest corner of the Monument, an ancient watering place and Papago village site. Today the little pond under its giant cottonwoods is a refuge and resting place for numbers of birds seldom seen in the desert—heron, ibis, baldpate, American pintail, teal, coot, killdeer, snipe, stilt, and sandpiper.

But the great Jesuit missionary-explorer Padre Kino found an Indian village here in 1700. And the lonely, wandering Franciscan Padre Garcés stopped at the pond several times between 1770 and his martyrdom in 1781. Captain de Anza, frontier warrior of Spain and leader of the expedition to colonize San Francisco, came here on his trail blazing in 1774. Much later, Quitovaquito was a favored watering place on the grim *Camino del Diablo,* the route followed by California-bound gold seekers, hundreds of whom found death in the desert beyond.

The road has recently been extended to form a loop from Headquarters via Dripping Springs in the Puerto Blanco Mountains to Quitovaquito. But when we went to Dripping Springs, we bounced along under ancient bare-limbed mesquites, through little meadows that are carpeted in April with blue phacelia and apricot mallow, and up a rocky bajada where Ajo lilies, yellow Malacothrix, and blue lupin bloom in the forgotten tracks. Palo verdes, ironwoods, barrel cactus, and saguaros crowded the washes or grew on the slopes of photogenic red buttes; and the buttes were dwarfed by the spectacularly banded Puerto Blancos, composed here of jagged volcanic flows and white tufa beds. The waters of the little spring formed tiny pools in a narrow arroyo. Once it was the haunt of Indian and prospector, but it is seldom visited today. We were the only car besides the Monument truck to penetrate it so far that spring.

And of course there is Alamo Canyon, northeast of Headquarters. This rugged, little-known country promises great entertainment for hiker and photographer. Mortars in the rocks beside its little stream tell of generations of vanished Indian women who once ground mes-



▼ Superintendent Supernaugh examines what he considers the prize organ pipe in the Monument. It is about 24 feet high and envelops a wiry ocotillo quite pods and wild seeds into meal, gossiping the while, no doubt, about family affairs and their husbands' hunting abilities.

If this canyon is not wild enough, there are others in the Ajo Mountains and across the valley in the Growlers which have scarcely been touched by modern man. For beauty there is the great saguaro forest on the southeast edge of La Abra Valley, where the giant cacti are reproducing themselves better than in Saguaro Monument. For strangeness there is the fantastic dwarf forest of white-spined cholla cactus, north of Aguajita.

But for us, time ran out. Luckily, our last trip fell on the Superintendent's day off. He is accustomed in his free time to take his family and visit still unknown parts of the Monument or check plant and wildlife conditions. This day he went with us to his favorite valley in the heart of Organ Pipe, far from the paved road. To reach it, we had to drive past the old Victoria and Martinez mines and over washed-out tracks that could not be followed by a modern passenger car. But once there, we saw the biggest organ pipe, the healthiest senita, and all the variety of Sonoran vegetation clustered in wonderful profusion.

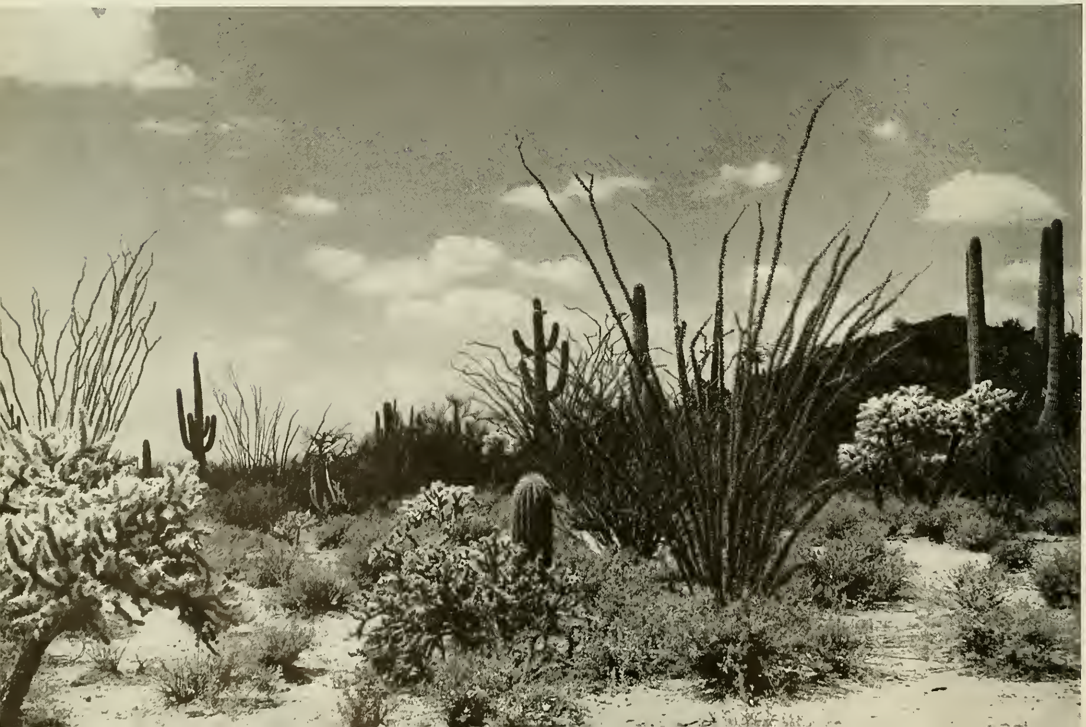
If Organ Pipe becomes a Park and recreational values are stressed, there should be more funds to develop roads and open such sections as this to the public. Supernaugh is hopeful of that result yet worried about it.

"We must be careful how we develop it," he declared as he looked fondly down the twisted sandy ruts and across wild La Abra Valley. "To most of our visitors, the aesthetic and recreational value is more important than the scientific. But we must see that plant associations and natural relationships are protected. Personally, I feel that the roads should be developed only as far as necessary to open the attractions here. I wouldn't like to see any more high-speed highways. I wouldn't want dance halls and merry-go-rounds and swimming pools and race tracks—the kind of things usually associated with vacation centers. Relaxation, rest, enjoyment of plants and animals and scenery—that's what we should offer to people who want and need and appreciate it."

Should Organ Pipe be made into that kind of a National Park? Perhaps the pictures accompanying this article will help answer that question and make nature lovers aware of the beauty of this natural garden on the Mexican border, which we believe to be one of our important natural treasures.

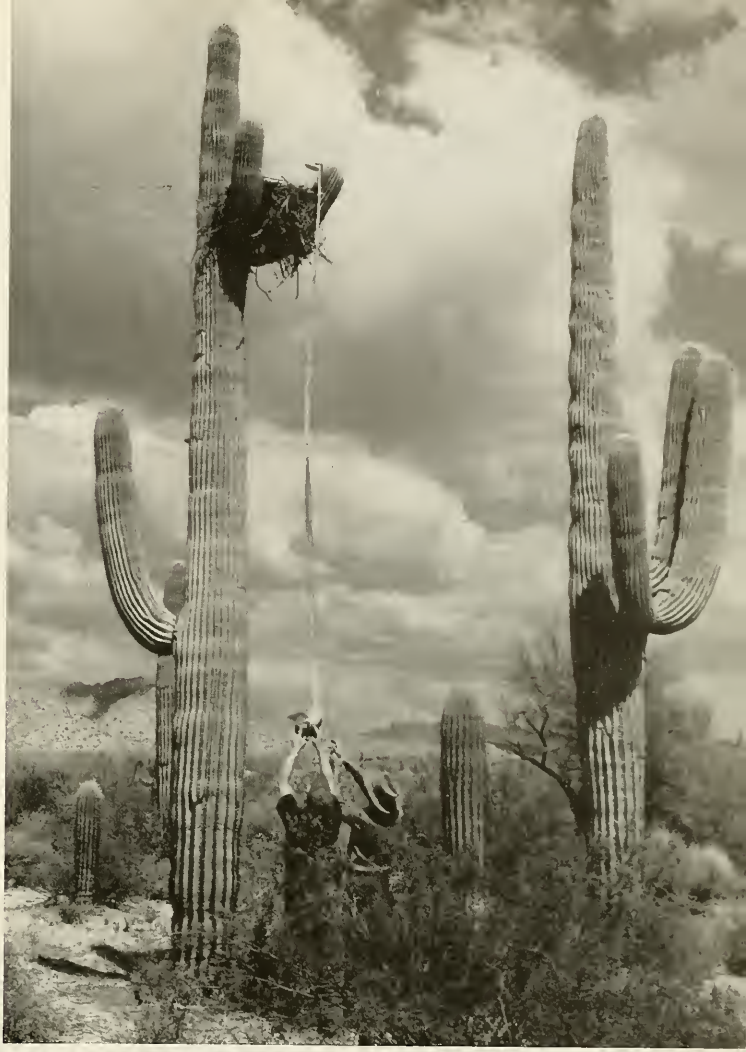
Nature spent thousands of years of struggle and evolution to march this spiny and thorny vegetation up from the tropics and concentrate it in these border valleys. We believe we should do our part by awarding it the privileges and stature of a National Park. This wonderful example of the desert should

▼ **The Superintendent** recommends most highly a visit to these beautiful gardens of Sonoran vegetation in the heart of the Monument—the finest virgin arboreal forms that any of our deserts can offer



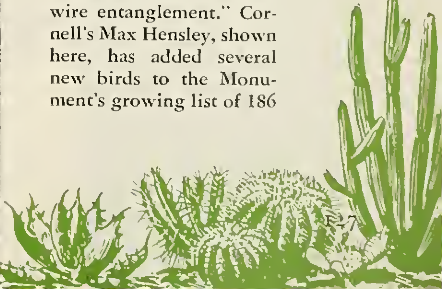
forever be kept free from the tinsel trimmings of a Palm Springs or the too-primitive discomforts of a so-called wilderness area. Of course, there would be no purpose in preserving it in the look-but-don't-touch tradition of an art gallery. To know the desert's beauty and worth, we must live with it, drive and hike through it, camp among its vegetation. It must be made available to all Americans—not just those who can afford the guides and pack trains and month-long stays that are so often the prerequisites of enjoying wilderness areas.

As Superintendent William R. Supernaugh puts it: "It's the supreme example of virgin arboreal desert to be found within the United States. Just as the Grand Canyon is the superlative of our canyons and Sequoia the cream of our forests, this is the unexcelled heart of our desert. When the desert is gone, the Southwest will have lost one of its major attractions. This part of the desert must be preserved so that those who will really enjoy and appreciate it can come here generation after generation and find these strange plants and animals preserved in their natural surroundings, just as they were before man came."

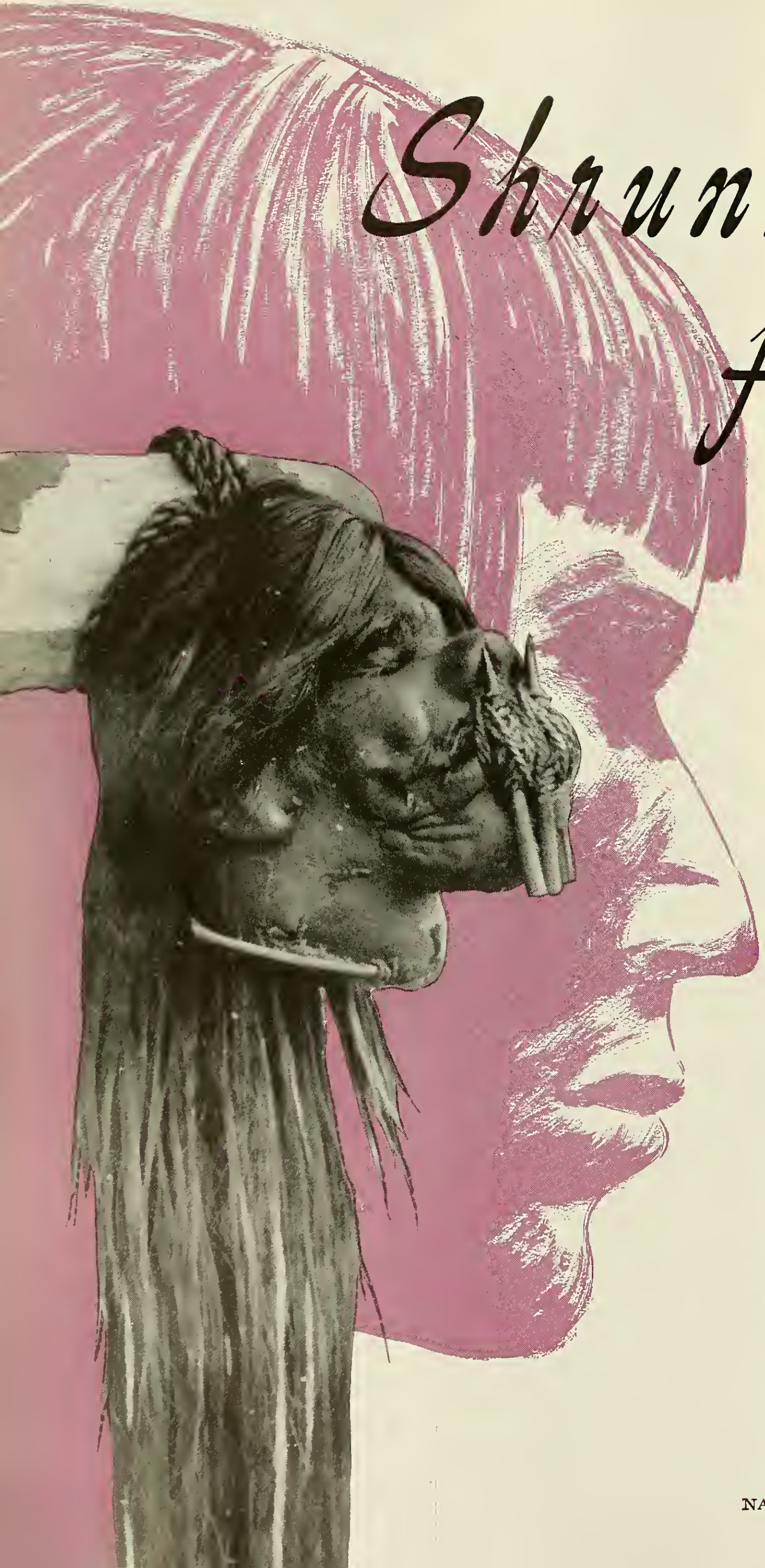


▲ PERISCOPE CENSUS-TAKER. A mirror fastened to the end of a dead Saguaro rib reveals to the Superintendent and his companion two eggs in this nest of the Red-tailed Hawk

◀ THE MIRROR is sometimes useful even at close range to avoid "barbed-wire entanglement." Cornell's Max Hensley, shown here, has added several new birds to the Monument's growing list of 186



Shrunken Heads



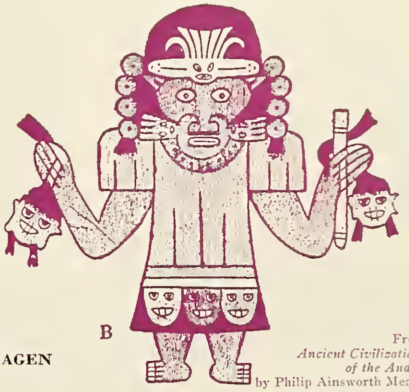
THE Tsantsa!

The most grotesque and horribly fascinating war trophy man has ever conceived—the human head of an enemy shrunk to the size of an orange, yet retaining all its human living features. The Tsantsa!—a word that carries hypnotic fear to thousands of Amazon Indians.

This shrunken head has mystified man for centuries. The civilized Incas were amazed by it and bartered for specimens of the trophy.

The Tsantsa also fascinated the early Spanish conquistadores, even while they were in the process of extracting tons of gold from the Incas. They first saw shrunken heads in 1532 on the coast of Ecuador. "Certainly," said one Spaniard, "it is a thing to admire and one never seen before. And so it seemed to us when we first saw it, holding it to be certain that they were faces of a race of dwarfs that had lived in the country, *until we learned the truth of the matter.*" But "the truth of the matter" was centuries-long being understood. In about 1862, the first shrunken head reached Europe, and when it was presented before the Anthropological Society of Paris, the learned doctors saw "that the Indians were very skillful in taxidermy." Other speculations regarding the shrunken head were not so exact. Some thought the Indians had a secret

One of the few explorers ever to see it performed describes the process of head-shrinking and the dramatic rites accompanying it among the Jivaros of the Upper Amazon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From *Ancient Civilizations of the Andes*, by Philip Ainsworth Means

By Victor W. von Hagen

process of shrinking the cranium along with the skin; others believed that the body was buried, then exhumed, and the head reduced in size. Still others believed the head was "boiled, stuffed with straw, and dried in smoke, thus forming a mask."

By the turn of the century, explorers had already seen the procedure—and described it; and in 1934, I attended a Victory Dance and saw the process of head-shrinking.

First we have the motive—which is, simply, war.

War is very important in the life of the Jivaro Indian. He is ruled by fear—fear of the unknown, fear of his fellow Indians, fear of the jungle spirits (he calls them *wakani*). And yet this Jivaro is no frightened weakling; he is one of the most intelligent and still one of the most ferocious of the jungle dwellers. The tribe lies scattered over thousands of square miles of jungle in the upper reaches of the Amazon and numbers now about 25,000. It is split into a number of subtribes, all speaking a dialect of a language which they called *shuara*.

There are no villages among them. Each house, an elliptical dwelling averaging sixty feet long with two entrances, is their castle. Made from the iron-hard wood of a chonta (hearts of chonta palms are a rare delicacy in America) and thatched with palm leaves, the dwelling is a veritable fortress. It has to be. As many as 30 persons may occupy a single communal dwelling—the elder and his wives and his sons and their wives. The braves hunt, fish, weave; the women are the agriculturists.

But like the Hatfields and the McCoys, they feud. They feud house with house, tribe with tribe. Killings bring reprisals, reprisals become blood revenge.

Even when sons are no more than six years old, the father will instruct them in blood revenge. They must revenge the killing of their ancestors, or the crops will suffer and the women will be barren (the worst calamity). Mere children will be taken on a head-hunting expedition to harden them to combat and to the horrors of blood revenge.

Before a head-hunt, the Indians gather to plot war arising out of grievances, real or imagined. A signal drum beats the slow, deliberate stroke of war and summons other related families from their jungle dwellings. By the time they arrive, the war party is pretty well into their cups from drinking a strong brew prepared by the women. They work themselves into a frenzy by reciting the grievances and are aroused to war-pitch. At night, in commando fashion, with bodies blackened, they set out. As soon as the men leave, the women, who remain behind with the very old and the very young, dance victory songs.

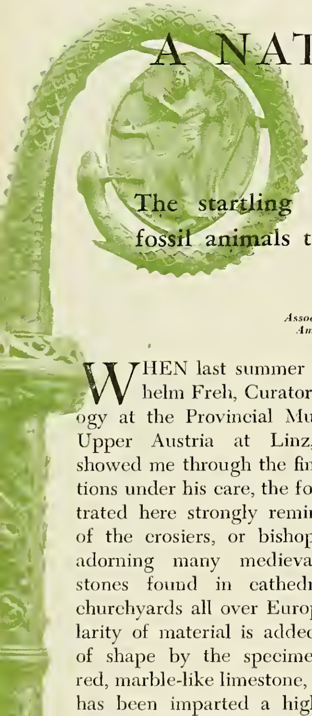
▲ Evidence that the rite is ancient: a cat demon holding a trophy in each hand. That they are true shrunken heads is strongly suggested by their relative smallness and by the lacing of the lips. (From an early Nazca pot, in the Gaffron Private Collection. After Seler)

When the enemy is surrounded, firebrands are thrown on the roof, and the attackers force the doors. Within, there is a dreadful scene of carnage. Everyone, even children under seven, are killed; so are the old women, all the men, and the dogs as well. Young women alone are captured and carried off. Then, with the attack complete, the head-shrinking begins. While the young squat about to watch, the killer removes the head, and an incision is made from severed neck to crown of head. The skin is cut low on the chest in V-shape and peeled upward. The skin is completely pried off the skull with a dull-bladed knife. Then, with the skin wrapped up in a piece of bark cloth, the head-hunters make off, for they soon will be the hunted when the relatives of the slain take up the blood revenge. Quickly, because putrefaction sets in rapidly in the tropics, the Indians squat by a riverbank and begin the first process of shrinking.

The skin of the head, with the long, matted black hair, is completely shapeless and now looks like one of Salvador Dali's drawings—"A Composition in Formless Heads." Into the lips three wooden pegs are driven, and these are wrapped with string. This will keep the mouth firm. Then the eyelids are skewered. The skin of the tsantsa is now placed in a jar filled with boiling water, and the astringent qualities of a vine called Pinginuka that is added will prevent the hair from falling out. Within hours, this process has reduced the head by more than a third. It now looks like a piece of hairy blubber. Next, a matter of tailoring. The incision that was made from the bottom of the neck to the top of the head to remove it from the skull is closed, and flexible vines are sewn into the base of the neck. This gives the Indian something to hold on to. Now, with the skin of the head held by the vine-stiffened neck, the head-hunter takes red-hot stones from the fire and drops them into the hollow head. The smell is like burning leather. The heat evaporates the oils and causes additional shrinkage. Hot sand poured into the head cavity has the same effect. At the same time, hot stones are applied to the outside of the face. The head is eventually reduced to a fourth its original size. Within ten hours the head is completely shrunken.

A corded string is passed through the crown of the head to provide a means of carrying the trophy; then it is wrapped up carefully in bark cloth and borne home in

Continued on page 141



Courtesy of Metropolitan Museum of Art

A NATURAL "Crosier"

The startling result of the uniting of two fossil animals that lived 170 million years ago

By Otto Haas

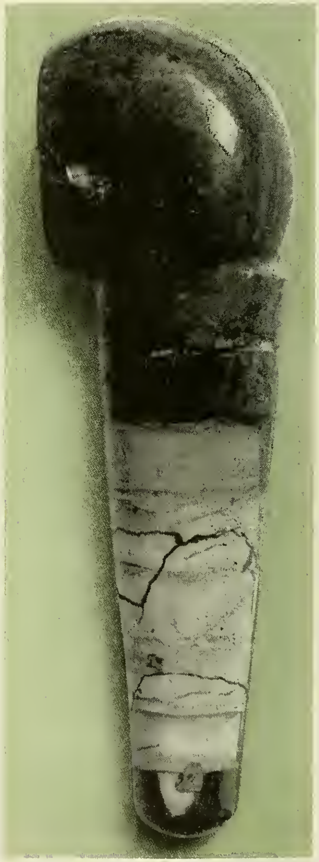
Associate Curator of Fossil Invertebrates, American Museum of Natural History

WHEN last summer Dr. Wilhelm Freh, Curator of Geology at the Provincial Museum of Upper Austria at Linz, kindly showed me through the fine collections under his care, the fossil illustrated here strongly reminded me of the crosiers, or bishop's staffs, adorning many medieval tombstones found in cathedrals and churchyards all over Europe. Similarity of material is added to that of shape by the specimen's dark red, marble-like limestone, to which has been imparted a high polish.

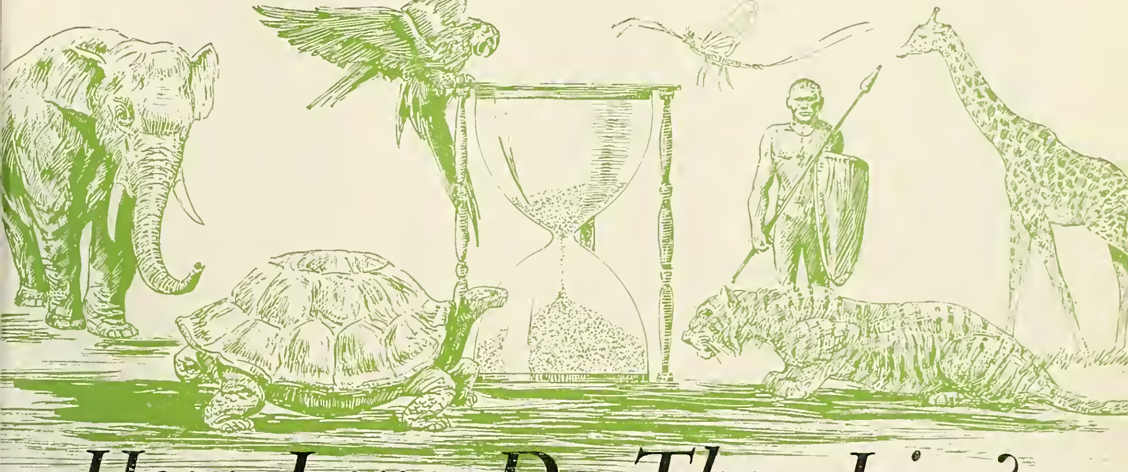
The "crosier" depicted here, however, consists of two fossils welded together, as it were, by a whim of nature. An ammonite (an extinct group of mollusks whose closest living relative is the chambered nautilus) contributed its spiral. A belemnoid (another extinct order of the cephalopods, related to the squids but with a hard shell) forms its straight part. The notch in the right outline of the "crosier" marks the boundary between them.

How did these two come to be so closely united? This can readily be understood if we visualize these fossils as the empty shells they were after the death of their inhabitants and before they were filled with calcareous mud that later turned into limestone. As clearly seen in the photograph, the straight quiver-shaped shell is divided into chambers. In the uppermost and widest of them, the coiled shell got stuck, and both became petrified in this position, in perfect alignment.

The scientific name of the ammonite (above) is *Proarcestes gaytani,* that of the belemnoid (below) *Atractites ausseeanus.* (The new generic name *Ausseites* has been proposed for this species.)



Both these animals lived about 170 million years ago in the sea of the Triassic, whose sediments are preserved as limestones in the Northern Calcareous Alps of Austria. The fossil discussed here is from the Raschberg, near Goisern, Upper Austria.



How Long Do They Live?

Man may have the old-age record among mammals, but he has yet to learn some tricks from the reptiles

By Osmond P. Breland

Drawings by Matthew Kalmenoff

PEOPLE have always been interested in life expectancy. That they are also interested in the longevity of animals is evident from the numerous stories published by newspapers and magazines concerning the extreme ages reached by various types of creatures. Unfortunately, many of these reports are far from accurate. They are based principally upon hearsay without positive proof. As a consequence, the majority of people believe that some animals attain a much greater age than they actually do.

The term "animal," incidently, is used by biologists to include any creature within the animal kingdom. It may thus be applied correctly to anything from the smallest one-celled organisms called protozoa up through the various worms, shellfish, and insects to the mammals, the class that includes man himself. It may offend some people to be classified as an animal; but if one looks at the situation objectively, he must admit that in many respects man is as much an animal as are many of the other living things so designated. In fact, it might even be argued that in some human beings several of the so-called "animal instincts" are better developed than in other creatures.

Most of the accurate old-age records for animals other than man have been obtained from zoological parks, but some apparently reliable reports have been obtained from private individuals who have kept animals under observation for a number of years. Conditions of captivity may have either lengthened or shortened the lives of these creatures. In the artificial environment, animals are sometimes given unfamiliar foods, and they may be exposed to diseases they might not ordinarily encounter. On the other hand, they are usually better cared for when ill, and they are protected from their natural enemies.

Some of the most amazing records for longevity have been established by creatures that are far below man in the scale of living things. Almost everyone who has spent much time at the seashore is familiar with the marine animals called sea anemones or sea flowers. These creatures are not very active. They usually remain attached to rocks or other substrata by one end of their columnar body. The end of the body opposite the point of attachment is a rounded disc containing the mouth and covered with many small projections, called tentacles, which greatly resemble the petals of a flower. When undisturbed, the sea anemone expands the disc, revealing the numerous tentacles. These creatures can usually be measured in inches, but some are as much as three feet in width. They are often brilliantly colored and are frequently responsible for much of the beauty of underwater landscapes.

Sea anemones belong to the same group as do corals and jellyfish, and all these animals have a very simple bodily architecture as compared with man or even with an insect. But we must look upon these lowly organisms with a certain amount of respect because of the known ages some of them have attained. Sir John Dalyall, English biologist, had one in his laboratory that lived for 66 years, while a Scotsman is said to have kept another for over 70 years. Others have been reported as living for more than 100 years. This may be true, but I have not been able to confirm the figure.

Facts are not available for many species of worms, but most of them probably do not live more than a few years as adults. Certain forms, however, have the ability to pass into a state of dormancy and in that condition may survive for a long time. The parasitic worms that afflict the larger animals are often very long-lived. Human flukes, such as the schistosomes and the oriental liver and lung flukes, may live 20 to 30 years in the human host. The larger human tapeworms, for example, the broad and beef tapeworms, are known to survive from 5 to 35 years, perhaps longer. And the roundworms of man may survive for 15 to 20 years, depending on the kind. The ability of the nematodes and some other animals to survive without food or water for many years has recently been discussed in NATURAL HISTORY.*

A few of the shellfish, a rather loose designation that includes clams, crabs, lobsters, and similar creatures, attain a respectable age. Clams are known to live for 15 to 20 years, and as much as 30 has been reported for some. Accurate data are not available for many

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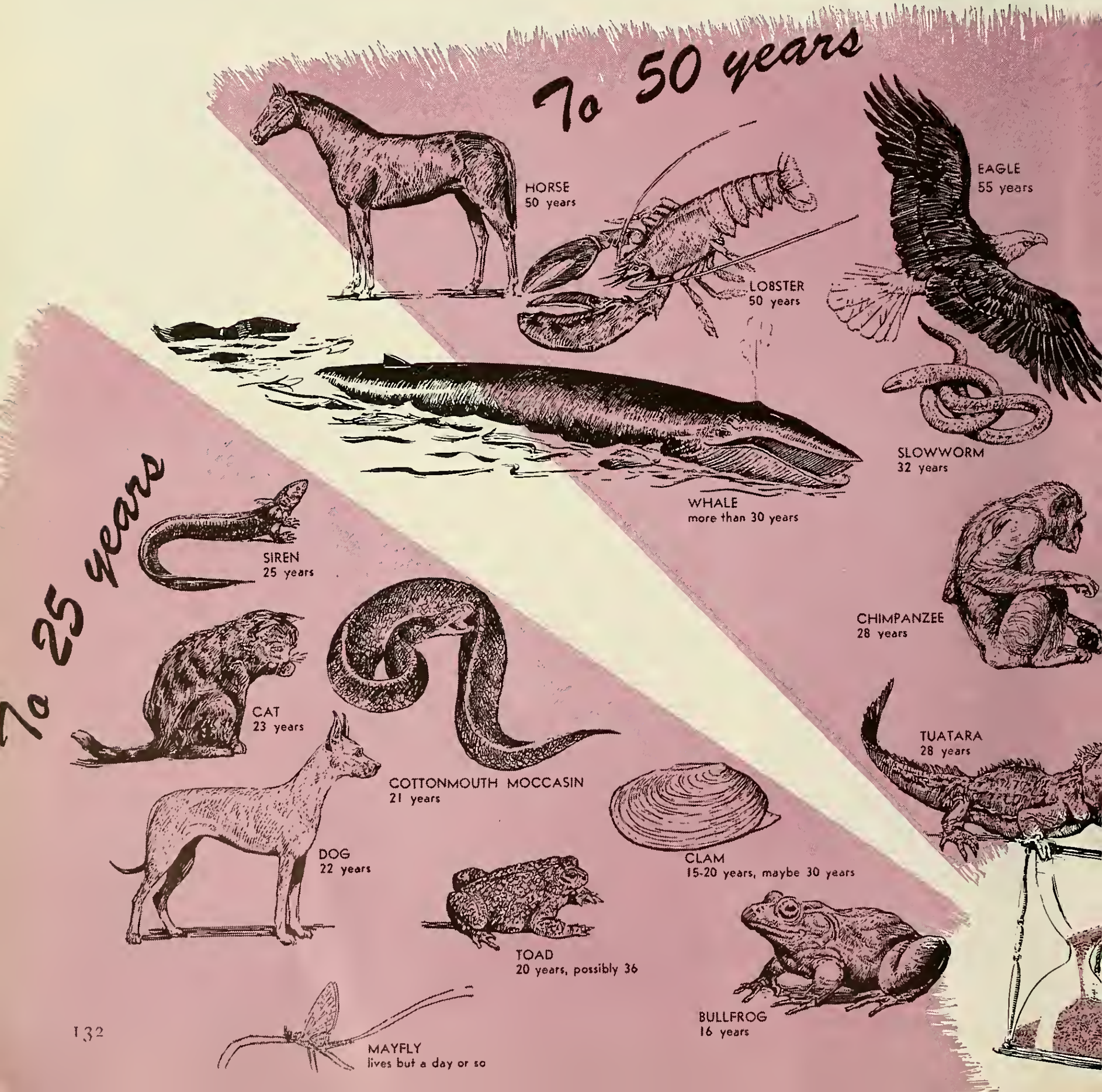
* November, 1950.


To 50 years
HORSE
50 years
LOBSTER
50 years
EAGLE
55 years
SLOWWORM
32 years
WHALE
more than 30 years
CHIMPANZEE
28 years
TUATARA
28 years
To 25 years
SIREN
25 years
CAT
23 years
COTTONMOUTH MOCCASIN
21 years
DOG
22 years
CLAM
15-20 years, maybe 30 years
TOAD
20 years, possibly 36
BULLFROG
16 years
MAYFLY
lives but a day or so

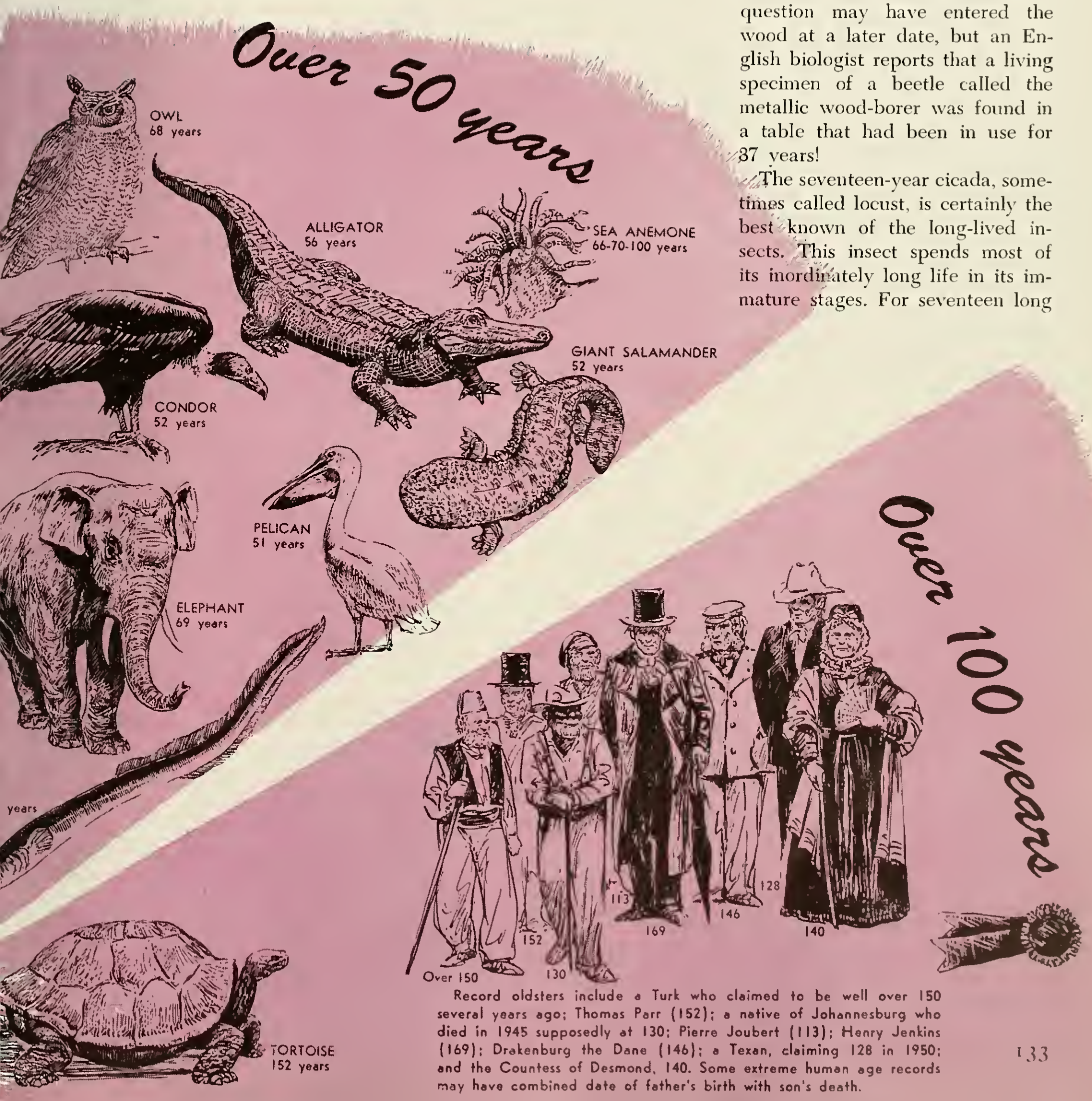
kinds of crabs, but the edible American blue crab seldom lives longer than 3 or 4 years. The American lobster occasionally reaches a weight of 30 to 35 pounds, and biologists have estimated that such monster individuals are probably more than 50 years of age.

Unfortunately, we do not have much information about two animals in this group, either one of which might well be the champion. These are the giant clam of the Pacific Ocean and the giant squid. Giant clams of more than 600 pounds are known, while specimens of the squid have been recovered with a length of over 50 feet. Large size does not necessarily mean great age, but the chances appear good that both these creatures live much longer than many for which authentic records are available. It has been stated that the large clams have been known to live more than a century; but so far as I know, this has not been verified.

The majority of insects live for only a short time, at most only a year or so, but a few, such as the queen of the honeybee, ants, and termites, live for several years. One instance is known of a queen ant surviving for 15 years. Worker ants are known to live from four to seven years.

Some of the wood-boring beetles normally take six to seven years for their full development as larvae. Under unnatural conditions, such as when a tree is cut up for use, the time may be increased, owing to the drying out of the wood. Perhaps the most amazing case of longevity among insects is such an example. There is, of course, always the chance that the insect in question may have entered the wood at a later date, but an English biologist reports that a living specimen of a beetle called the metallic wood-borer was found in a table that had been in use for 37 years!

The seventeen-year cicada, sometimes called locust, is certainly the best known of the long-lived insects. This insect spends most of its inordinately long life in its immature stages. For seventeen long



Record oldsters include a Turk who claimed to be well over 150 several years ago; Thomas Parr (152); a native of Johannesburg who died in 1945 supposedly at 130; Pierre Joubert (113); Henry Jenkins (169); Drakenburg the Dane (146); a Texan, claiming 128 in 1950; and the Countess of Desmond, 140. Some extreme human age records may have combined date of father's birth with son's death.

years the young cicadas live underground, burrowing through the soil and feeding upon the roots of plants. At last the big day arrives, and the youngsters, somewhat resembling chubby crawfish, scramble out of the ground in uncounted numbers. They shed their skins, mate, and die within a few days or weeks.

It is a well-known fact that many fishermen exaggerate occasionally when telling of the number and size of the fish they have caught. Even the ages of fishes have not escaped the fish story tendency. And so we read of a pike that lived in a German lake for 267 years, and of carp that have survived for more than 150 years. Unfortunately for the sensationalists, there is no evidence that these fish stories are correct, and there is some reason to believe that they are incorrect, despite the fact that well-known encyclopedias have cited these as authentic examples of extreme age. The skeleton of the famous pike, long preserved in a museum, was found to be composed of the bones of several different fish. And an investigation of the reportedly aged carp revealed that they were not the original fish that had been placed in a pond many years before, but instead their descendants. The European catfish or wels, a species that may attain a weight of several hundred pounds, is thought to hold the age record for fishes. There is considerable evidence that two of these fish may have lived for more than 60 years in a lake in England. An eel in Europe, which may well have been a moray, because it was an ancient custom to keep these as pets, is second, with a known life of 55 years. The American eel is said to have survived for 50.

It is possible to determine the age of many fishes by examination of their scales. This technique will doubtless greatly extend our knowledge of the longevity of fishes in years to come. The reader can find a good bit of information on this subject in J. R. Norman's *History of Fishes.*

The greatest known age for an amphibian has been established by the giant salamander, a species that occurs in Japan and adjacent areas and attains a maximum length of more than 5 feet. One specimen was kept in a zoological park in Leyden, Holland, for 52 years. A European toad is thought by one authority to have lived for 36 years, which is a rather remarkable achievement. It is hardly necessary to state that the belief, held by some people, that toads can live for hundreds of years sealed in solid rock has been disproved many times.

Large turtles and crocodiles are the most famous of the alleged reptilian Methuselahs. A newspaper article some time ago gave a well-known physician as authority for the statement that large sea turtles may live for as much as 5000 years. The truth of the matter is that no one knows how long these turtles can live, although in view of the known ages of other reptiles, the 5000-year figure appears more than slightly excessive. The greatest reasonably verified age records among reptiles have been established by some of the large tortoises. These tortoises are entirely land inhabiting, and outside of zoological parks they are relatively rare. They are natives of several groups of islands, including the Galápagos Islands off the coast of South America. Biologists who have investigated the matter have credited certain of these tortoises with more than 150 years of life, with the admission that some may live as long as 200.

One Marion's Tortoise *(Testudo sumeirei)* is reasonably well proved to have survived for 152 years, when it was accidentally killed. And back in 1923, the New York *Times* ran an article under the title, "Turtle Branded by Captain Cook in 1773 is Now Found Alive." The article referred to a tortoise from the Galápagos left on Tonga Island 150 years before, but no one has reported whether it continued to live. Apparently it was showing signs of extreme old age, for the captain of the ship was quoted by the *Times* as reporting that it was blind and that it creaked like an ox cart when it walked.

Even the relatively small Carolina Box Tortoise of the United States is believed by some authorities to attain an age of more than 100 years. The principal evidence for this great age among tortoises seems to be based upon intermittent observations on certain marked individuals over a period of years. None of these reportedly ancient tortoises, so far as could be determined, have been under careful enough supervision to make sure that another animal might not have been substituted for the original one. On the other hand, competent biologists have provisionally accepted 150 to 200 years as the probable life span of some of these reptiles.

Some writers have stated that certain sacred crocodiles of India have lived for more than 200 years, but authentic records do not confirm this. The oldest known crocodilian was an American alligator that was a resident of the Dresden Zoological Park in Germany for approximately 56 years. This reptile was still alive according to the last report available to the writer.

Parrots, swans, and eagles are often stated to live for more than 100 years. However, many of these statements are based upon reports that originated several hundred years ago. They are obviously difficult to prove or disprove. Modern study does not give the bird clan nearly as much life expectancy as do the older claims. According to a recent investigator, the oldest established bird ages include an owl of 68, an eagle of 55, a condor of 52, and a pelican of 51—a rather far cry from the five-score-plus previously credited to some of our feathered friends.

Aside from man, the life span of elephants has doubtless received more attention than that of any other mammal. Until a few years ago, even competent biologists believed that elephants lived to well over 100. The late Major Stanley Flower, well-known authority on

Continued on page 141

A.M.N.H. photo

▲ THE WHITETAIL in a typical setting, exhibited in the Hall of North American Mammals at the American Museum

The White-tailed Deer

Conservation has fortunately made it possible for this large, graceful animal to survive the inroads of civilization over most of the eastern part of the United States

YOU may see the White-tailed Deer in the woodlands almost anywhere from the Atlantic seaboard to the Great Plains, and from the Gulf of Mexico northward through most of the States. The haunt of the Whitetail is woods and thickets alternated with open forest glades. The range of the individual is small, and it is not gregarious. It will eat grass, but buds of brushwood, twigs, and leaves are essential to its diet. Its hearing and sense of smell are acute, but its eyesight is not.

The mating season is in November, and the one or two fawns are born in June. Only the buck has antlers, and these are shed each year in January. New antlers start to grow a month later. During growth the antlers are covered with velvet, have blood vessels, nerve systems, and are sensitive. The sexes are alike in color but have noticeable seasonal variation. The males weigh from 150 to 300 pounds and the females from 100 to 150. The large tail, snowy white on the underside, which the animal carries aloft in a conspicuous manner when it is alarmed, is characteristic of this deer.

The fawn of the White-tailed Deer is one of the most appealing creatures of the woodland and endears itself as a pet, but with maturity this soft-eyed animal can actually be quite dangerous.

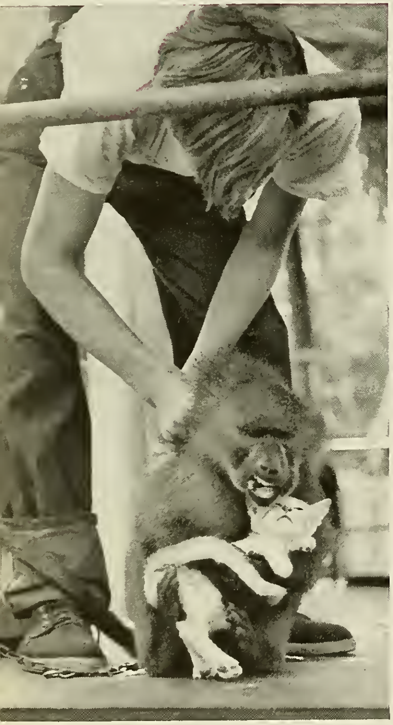
The Baboon that "Mothered" a Kitten

A remarkable series of photographs showing that a female baboon can treat a kitten as if it were her own

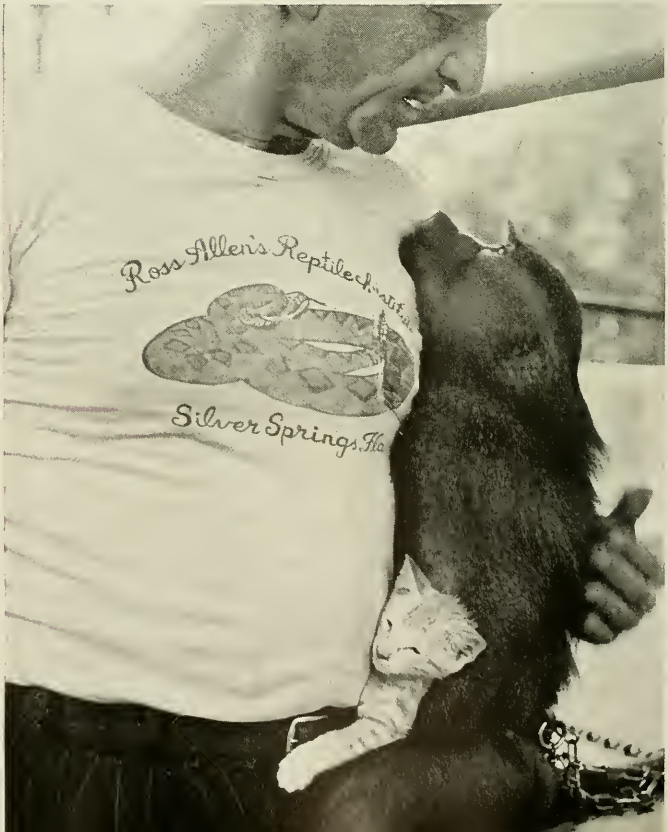
By Kurt Severin

All photographs by the author

HELEN, the baboon shown in these photographs, was several years of age when she adopted Fluffy, a young kitten. Both animals belonged to trainer Morris A. Osborn, who at the time handled a monkey show for the Ross Allen Reptile Institute. Helen adopted the kitten immediately and without reservations.



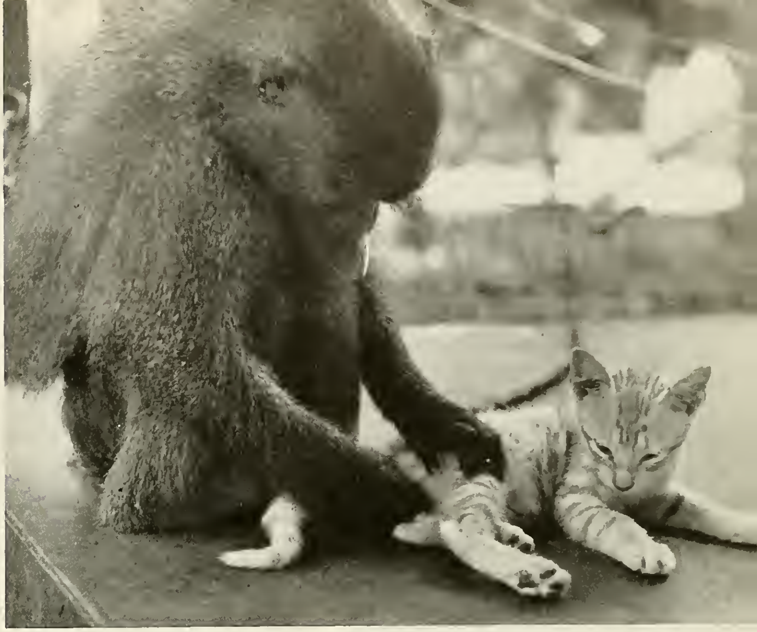
▲ Possessive. When her trainer's son threatened to take Fluffy away, the baboon ferociously defended her



➤ Only trainer Morris A. Osborn inspired confidence in Helen when she was in the presence of her kitten-baby. She trusts him implicitly, as is clearly evident in this remarkable pose

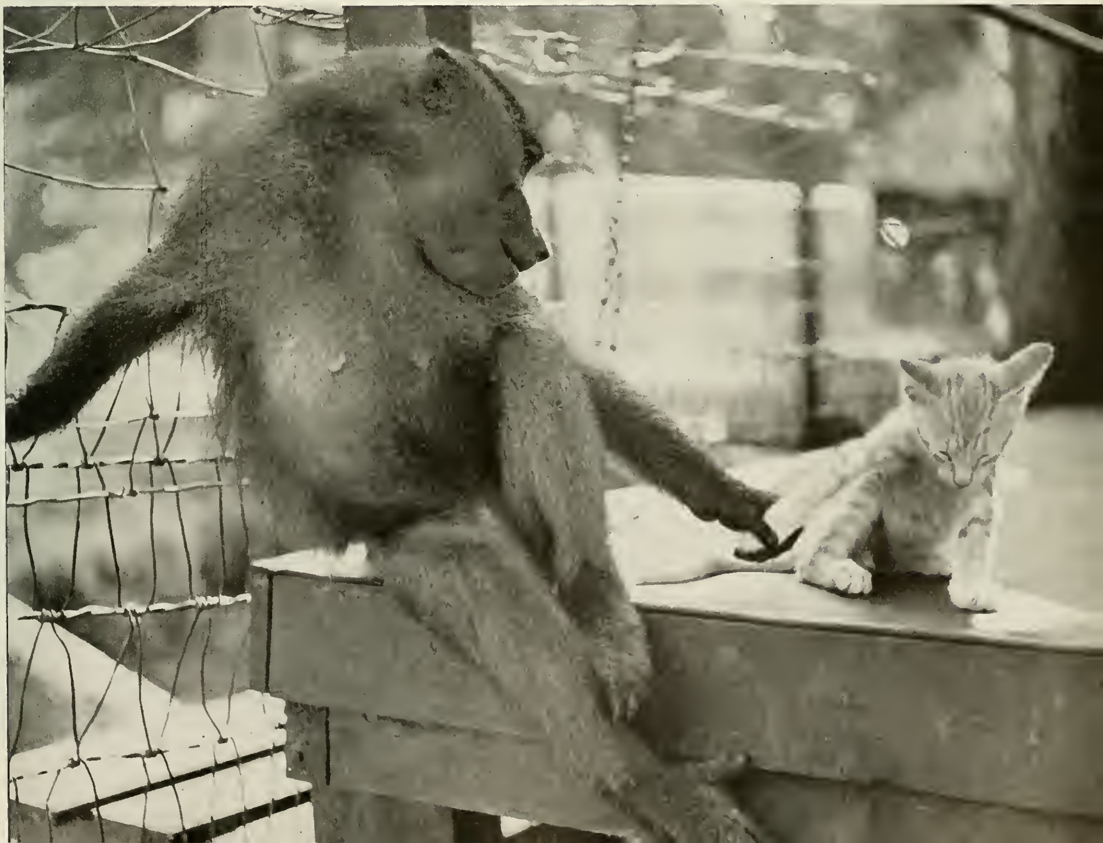
So completely did the kitten seem to fill some emotional need in the foster mother that the baboon would struggle to hold onto her adopted baby whenever anyone tried to take it away. Indeed, the monkey's possessiveness made it difficult for the kitten to get a good night's rest or even some hours of leisure away from her overjealous foster mother. Only Mr. Osborn could induce Helen to let go of the cat, by talking to her and petting her.

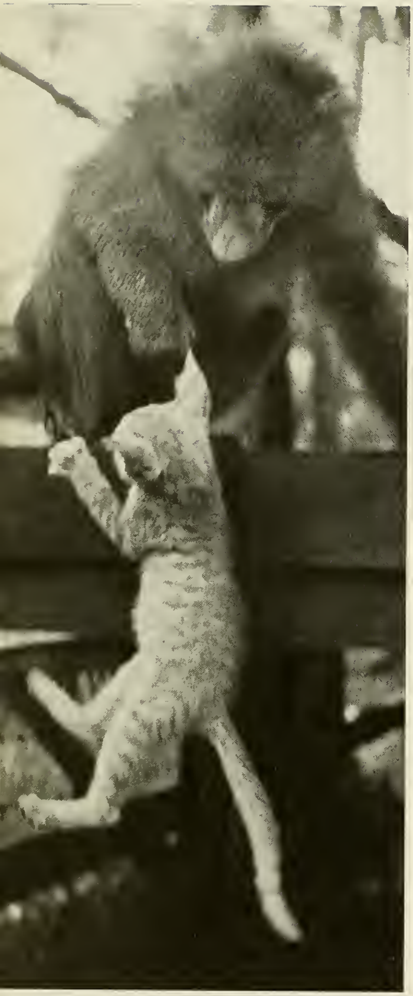
These photographs were made at Silver Springs, Florida, without any preparations or setup. I simply watched the strange spectacle and took photographs at significant moments without flashes, artificial lights, or any attempts to pose the animals. The ape's attitude toward her kitten was one of the most fascinating things I have observed, and I hope these photographs will convey some idea of this interesting relationship.



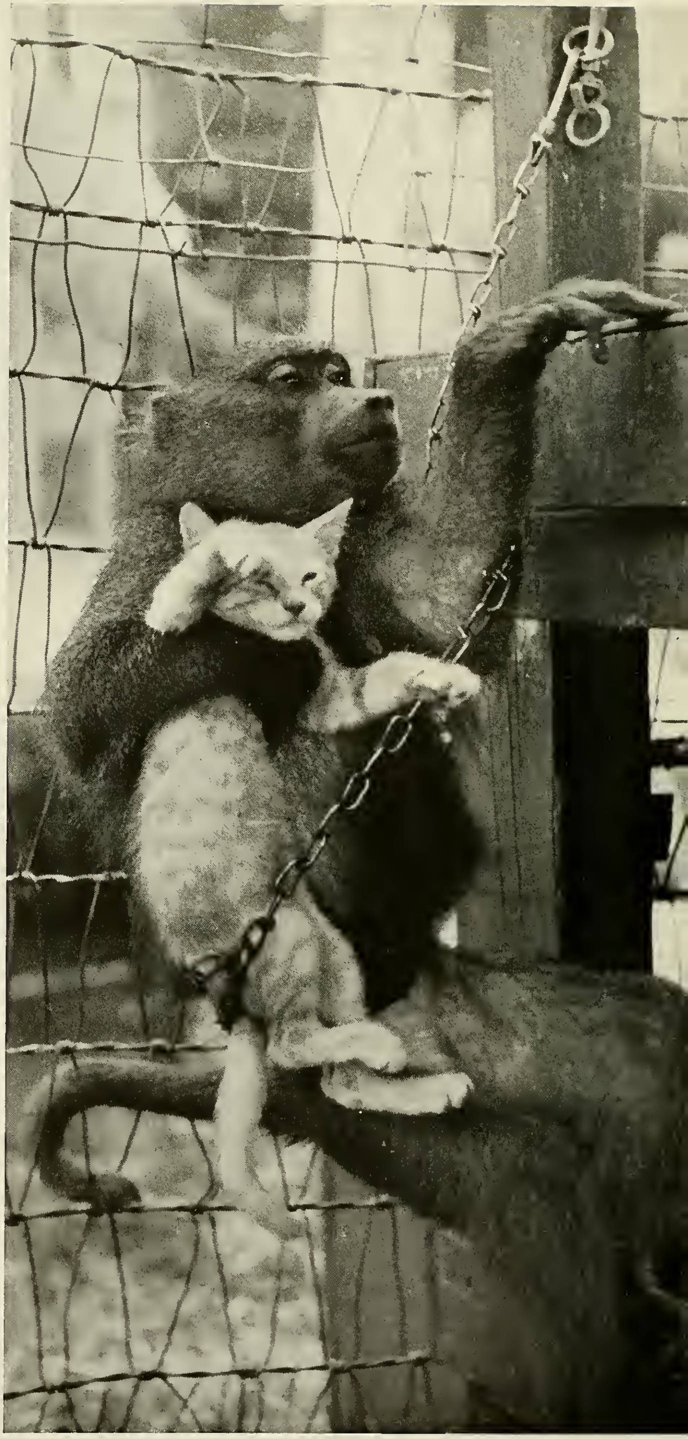
▲ **Helen** went through the cat's fur in the usual monkey fashion, hunting for salty particles. Fluffy did not mind this procedure at all

▼ **Sometimes** Helen was more anxious to play than Fluffy





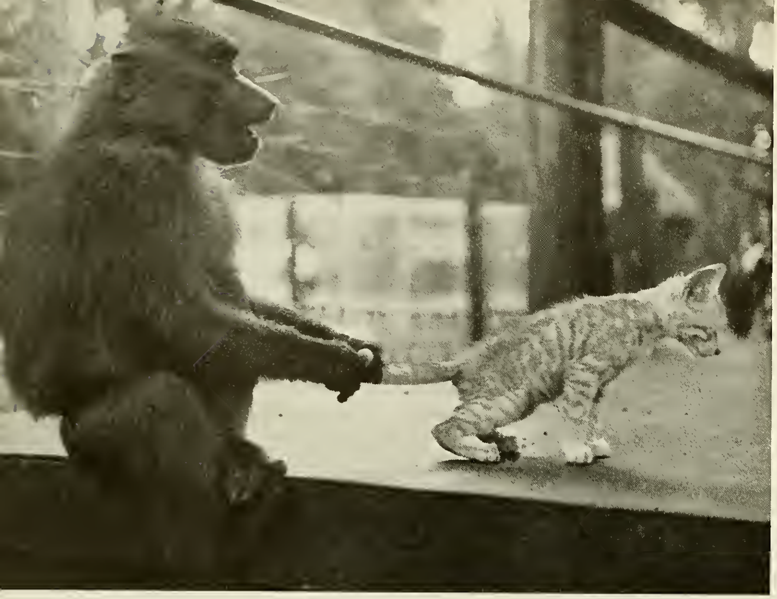
⮝ A WAR of wills



⮞ LIKE A GIRL who could not be separated from her favorite doll

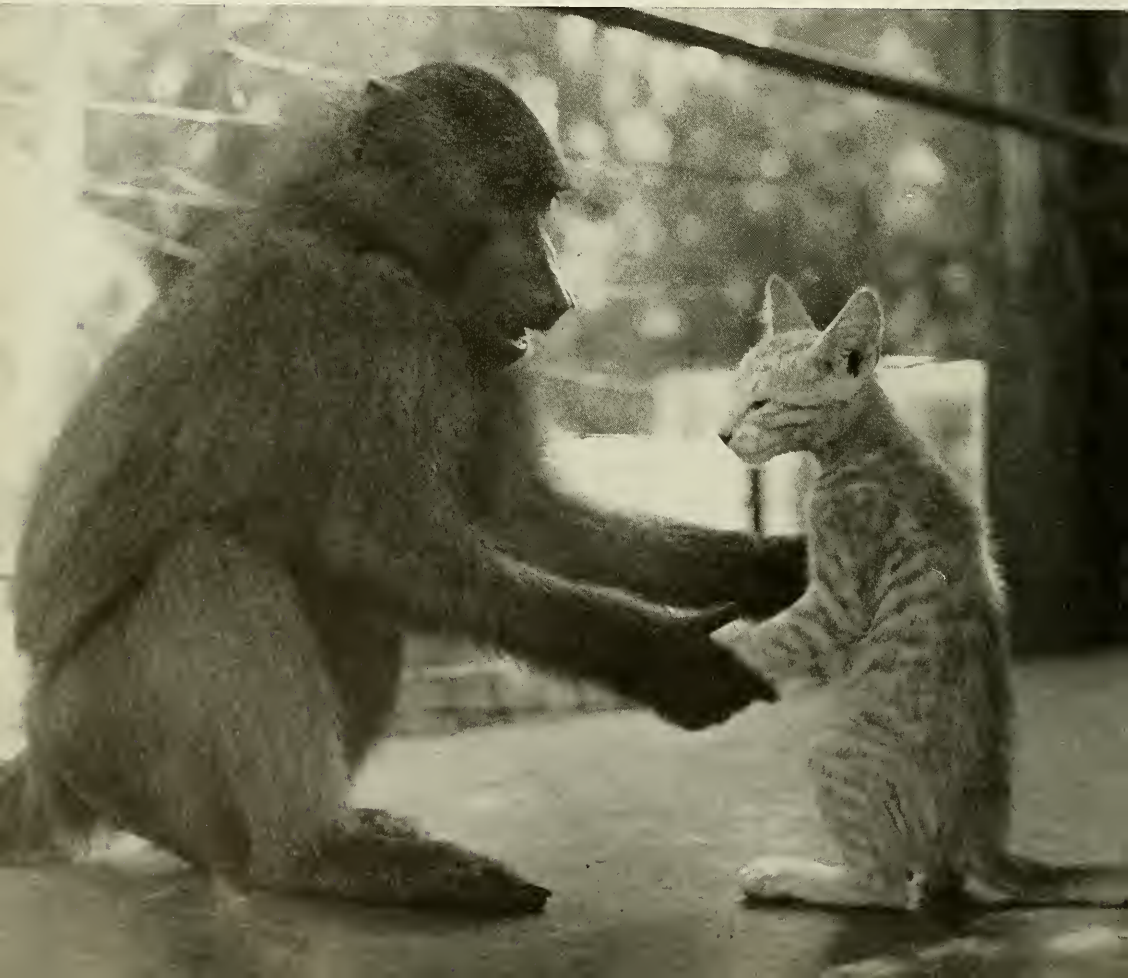
> **All in fun.** The baboon was very gentle with her adopted child, but a little rough play was occasionally enjoyed by both

˅ **Observers** on the spot were convinced that the baboon wanted the kitten to look at herself in the looking glass, but animal psychologists insist that such an interpretation goes far beyond what is known about baboon psychology



< THE KITTEN sometimes appeared to be unwilling to be tied to *anyone's* apron strings

∨ HERE AGAIN, many who have watched Helen and Fluffy feel sure the baboon tries to make the kitten sit up like a proper ape. But students of animal behavior assert that this assumption goes far beyond the facts



SHRUNKEN HEADS Continued from page 130

triumph. Once the house is reached, the head is placed above a fire to be cured and tanned by the smoke smudge.

Now the victory feast. This involves time and preparation. Bowls of fermented liquor have to be prepared; food hunted, smoked, and made ready. The men must weave new tunics for their wives. The boys must hunt for plumes for their headdresses. When the victory feast takes place, hundreds of Indians arrive—plumed, painted, and expectant. In the dark of the night, with fires burning fiercely in the center of the house, the women and men join hands, dance and sing, sing and dance—the victory song. The orchestra is a drum, a two-note flute, and insect-wing rattles. Then, at the precise moment, the killer arrives at the open door—with the shrunken head of his enemy around his neck. The victory yell. Then the drunken dance orgy again, past the shrunken head. It is being insulted. For if a man is dangerous when he is alive, he is twice as dangerous when he is dead. The "soul" of the shrunken head, still wielding great power, must be cowed by the dance, by the shouting. Why? So that the innate power of the soul of the shrunken head, instead of using its forces to harm its killer, will use them to help him. And the victor's wives will produce more children, his fields will become more fertile, his prowess at hunting will improve. Evil becomes good.

And what becomes of the head after this metaphysical mumbo-jumbo? Well, one time the Indian buried it, burned it, or threw it away. Now he knows—thanks to the white man's curiosity—that it will bring a good shotgun in trade.

Trade in shrunken heads is brisk in Ecuador. It is black market, but it—the market not the heads—shows no shrinkage yet.

HOW LONG DO THEY LIVE? Continued from page 134

animal ages, recently investigated the question of elephant longevity. He found, much to the surprise of many people (including the writer), that the greatest established age for one of these creatures was approximately 69 years.

Several other elephants were discovered that had lived for more than 60 years, but centurians were sadly lacking. Most biologists are agreed, however, that the elephant is the longest lived mammal, excluding man, and it seems possible that an occasional individual may live past the century mark. A few domestic mammals have done well. A horse of over 50 years seems authentic, while a cat of 23 and a dog of 22 have been provisionally accepted.

Unfortunately, positive figures are nonexistent on the life expectancy of whales, the largest of the mammals. It seems unlikely, however, that these creatures live nearly as long as might be expected of animals that grow so large. Some whales may be more than 25 feet long at birth, and they may double their length and become mature in the incredibly short time of two to three years after birth! Harpoons, marked with the date of manufacture, have been recovered from the bodies of whales, and some biologists believe that a study of the female reproductive organs will give some indication of the age of individual specimens. It appears well established that whales may live more than 30 years, but estimates of 100 years, based principally upon a study of female reproductive organs, seem somewhat excessive. We would know more about whales if some ambitious person would corral a herd of them and keep them under observation for many years. But this is obviously a task not likely to be undertaken in the near future.

Almost all cases of great age in human beings are based upon hearsay rather than upon registered birth records. Indeed, hundreds of years have passed since some of the most famous "record holders" lived. Some of the most frequently cited ancients include Henry Jenkins (169 years), Thomas Parr (152), Katherine, Countess of Desmond (140), and Christen Drakenburg (146).

In a recent book written by statisticians of the Metropolitan Life Insurance Company, the reported age of Christen Drakenburg is the only one taken at all seriously. The records of this individual are thought to be reasonably reliable, although it must be admitted that even these may be incorrect. Drakenburg, a Dane, was said to have lived from 1626 to 1772, or 146 years. That he was vigorous well past the prime for most men is supported by the statement that he married at 111, and that after the death of his wife he proposed marriage to several other women when a mere 130 years of age. Surprisingly, perhaps, all these suits were rejected.

Certain other investigators, however, do not recognize the claim of the Danes that this countryman of theirs should be extended the victory wreath for having outlived all other modern human Methuselahs. Dr. Maurice Ernest, English biologist who has investigated the question of human longevity, would award the prize to a Canadian, one Pierre Joubert, whose record is more modest. This man, born in Quebec County in 1701, is thought to have lived more than 113 years.

Coming to more recent times, we find that in 1945 an African native died in Johannesburg who was alleged to have been 130 years old. According to newspaper reports, several investigations of this matter were conducted, and although the investigating agencies did not agree as to the native's exact age, all were convinced that he was over 120 years old several years before his death.

The year 1950, like other census years, has produced its quota of stories about aged individuals. The oldest claim noted so far by the writer has been made by a man living in Brownsville, Texas. He is stated to have told the census taker that he was 128 years old, and this approximate age was supported by his relatives. This age has not, so far as I know, been confirmed by official records, although it may be correct. One of the most publicized cases is the Turk who made a trip to the United States several years ago and claimed to be well over 150.

It is rather obvious that it is not possible to state positively the extreme age to which human beings may live. It is certain, however, that it is well past the century mark. More exact figures are available regarding the *average* length of human life. In the United States as of 1946, the average life of white men was slightly more than 65 years, while that of white women, the supposedly weaker sex, was over 70 years. When we compare these figures with an estimated average life of 33 years in England during the Middle Ages, it is apparent that the life expectancy of the human race has been lengthened enormously.

It must be realized, however, that this very satisfactory increase does not necessarily mean that the human body is any more capable of living longer today than it was many years ago. Average life figures are based upon the length of life of many thousands of individuals, including those that died in infancy. By far the greatest increase in human life expectancy has been made because of fewer deaths from infectious diseases and a reduction of infant mortality.

Do human beings live longer than any other animal? According to all available evidence, man's principal competitors seem to be members of the tortoise clan. If one surveys the vast array of literature dealing with the longevity of animals, he will find supporters for both sides of the argument.

Perhaps a more important question is, what can we learn from the animals that will help us solve the problems of aging? Physiological studies may cast a great deal of light on the whole subject. Today as never before, science is being brought to bear on this question, which is naturally of vital interest to everyone, and perhaps some of the answers to our own problem will be given by the animal Methuselahs.

SUPER-GRANDPA

Recently Gustaf Hakansson, 66 years old, bicycled the length of Sweden, 1162 miles, in 7 days, with a total of only 10 hours sleep. —*Sweden Illustrated*

LETTERS

Continued from page 97

how much do you need?

I am not rich, but I'll do all that I can do (I have two young children who come first) to stop these nutty nimrods.

W. C. King, Jr.

Gloucester, Va.

Sirs:

I have just had the pleasure of reading Olaus Murie's delightful article in Natural History, "Do You Want Hunting in National Parks?"

I feel this article is timely and well written and that its logic and arguments are unassailable. Such an article as this will undoubtedly render a great public service.

Clarence Cottam,
Assistant Director,
Fish and Wildlife Service.

Washington, D. C.

The Wolf

Sirs:

I fully agree with your reply to Mr. Osborn in the January, 1952, issue of Natural History on the gray wolf. The advancement of man and his civilization has either directly or indirectly destroyed the balance of nature. This balance is as important to man as it is to other organisms, because it provides a living for all. When conditions such as those in Alaska are present, some animal, the gray wolf, is blamed for man's mistakes. . .

Homer V. Griffin.

Paonia, Colo.

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WARD'S Natural Science Establishment
Box 24, Beechwood Sta., Rochester, N. Y.

From a 13-year-old French girl whose father is with the U. N.:

Sirs:

I was shocked to read Mr. Osborn's letter in the January issue concerning the Gray Wolf. That someone reading a magazine on natural history should be so blind, unreasoning, and prejudiced on this very important subject is both amazing and shameful.

The wolf is certainly less a menace to our domestic animals than sickness and accident made by man's carelessness. And as you rightly pointed out, during the centuries they were together, the gray wolf did not reduce the great caribou herds of Alaska on a scale to be compared with man's destruction since he came there only a few years ago.

It was not the wolf who killed the buffalo (or bison), the passenger pigeon, or the ivory-billed woodpecker.

Neither shall it be the wolf who will kill our remaining big game but man-the-hunter, unless some other men, who have at last awakened to the grandeur and beauty of our country, should prevent them and help keep the wolf safe as well as the deer, the moose, and the caribou.

With my best wishes for your Magazine,

Florange Arabelle Grandjouan.

Glen Cove, N. Y.

Hibernating Mother

Sirs:

Having been a subscriber to the Natural History for at least 20 years, I am seeking the following information. I have read that bear cubs are born while the female is hibernating, two months before she leaves her den, and that she is unaware of this event.

Now I lived on a farm for many years in my younger days and have seen a variety of domestic animals born from kittens to horses. Never once were the mothers oblivious of the birth of their young. In all normal births the mothers are much concerned and assist their offspring in searching for food. Especially is this true in minute-old pigs. When the little pigs begin to root about, the mother sow turns on her side to give them all a chance.

I am not an animal obstetrician or a veterinary surgeon but have helped in delivery many times and can swear that the female was aware of what was happening and was also often definitely in distress. Now how can anyone know what happens to the mother bear at this time? Is she dreaming peacefully, and do the cubs receive any food for the next two months? . . .

If there is anything authentic on this subject, please write me.

Byron W. Palmer, D.D.S.

Ontario, N. Y.

The following information is given by George G. Goodwin, of The American Museum's Department of Mammals:

Technically bears do not hibernate as do animals like the woodchuck, for example. Hibernation is a perfect state of lethergy, when the body is insensible to sound or touch and its temperature is reduced to between 43 and 57 degrees Fahrenheit. Respiration is at a low ebb in true hibernation and cannot be detected without instruments. It may completely stop for periods of from three to eight minutes. The body temperature of a bear remains normal during its deepest winter sleep. Its breathing continues at the rate of four or five complete respirations a minute, the equivalent of a person in deep slumber.

Cold weather makes a bear drowsy, and the animal holes up for varying periods of time, depending on the climate in which it lives. In a country where the winters are cold, a bear may enter its den in October and stay there until April or May. A bear's winter sleep is broken by intermittent periods of semiwakefulness. At times, it may even be wide awake and wander about over the snow in midwinter before turning in again. The winter den may be the hollow trunk of a tree or a cave in the rocks.

A pregnant female takes pains in the selection and preparation of a comfortable winter dwelling. The place usually has a southern exposure, and the bed is lined with leaves to eliminate draughts. In such a position the cold north winds will cover and insulate the den with snow.

The prospective mother bear goes into the winter den early and stays there until late spring.

The mother bear gives birth to her offspring easily. At birth the cubs are very small, naked, toothless, and blind. The cubs of a black bear, for instance, are actually smaller than a newborn Canada porcupine. They are about nine inches long and weigh between six and eight ounces each, which is only one five-hundredth of the weight of the mother. The cubs of the big brown bear and the polar bear weigh about two pounds at birth. There can be no comparison here with the birth of a calf or a lamb, especially in domestic stock where the young are often born exceptionally large.

There is no doubt in my mind that the mother bear is aware when birth takes place, though she may not be disturbed and dozes on. The young are well able to find their way unaided to the mother's teats and snuggle between her legs for warmth, protection, and food. Forty days later the cubs open their eyes and cut their first teeth.

Bears breed when three years old. Females usually have twins, but there are occasionally three and sometimes four young in a litter.

Walrus

Sirs:

By now you have undoubtedly received a number of replies to your request for information concerning the large numbers of walrus washed ashore on St. Lawrence Island. I am writing merely to point out that this is not the first recorded instance of such a phenomenon. Victor Cahalane reports in his *Mammals of North America* that in about 1936 a school of walrus was driven ashore, also on St. Lawrence Island, and they were so badly frightened that over 200 were smothered or crushed to death in the pile-up that occurred as they made their way up the beach. It is believed they were driven inshore by killer whales, which are one of their most serious enemies. It is quite possible that this later record, which you report, is a result of the same series of circumstances.

William V. Mayer,
Zoology Department,
University of Southern California.

Los Angeles, Cal.

If the walrus in the present instance were known to be alive when they reached the beach, Dr. Mayer's explanation might be the right one, but it appears more likely that they drifted ashore in a lifeless condition. —Ed.

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Sirs:

Recently I acquired a copy of Natural History and was astonished to find that such an interesting magazine is published. . .

(Rev.) Ernest Bartels,
Clear Creek Lutheran Parish.

Osseo, Wisc.

Sirs:

. . . I want to say that Natural History is the finest magazine of any kind and the only periodical I can be depended upon to read from cover to cover regularly. Thanks for the most refreshing and stimulating form of writing done today.

Jane R. Porter.

Smith College,
Northampton, Mass.

Sirs:

Yesterday I had the pleasure of sending you, registered mail, my check covering renewal subscription to Natural History for 1952.

After having thoroughly read each issue in 1951, I now wish to take the opportunity to compliment your organization on one of the most outstanding educational magazines it has been my good fortune to read.

Here's to the greater success of Natural History in the future and to the continued pleasure of spending more hours with your exceedingly interesting publication.

Horacio Gonzalez G.

Caracas, Venezuela.

BOOKS

Continued from page 102

It gives information on practically every sport and nature hobby. Many of the irrelevant subjects such as Flexichrome prints, color developing, table-tops, pinhole photography, etc. would have been better left to others; after all, we are supposed to be reading about how to make photographs of sports allied to rod and gun.

Photography Afield is divided into two main sections, stills and movies, with information in each applicable to the other. Each section starts off with a discussion of equipment, swings into how to use the camera and all the accessories, and then graphically discusses how to compose a picture better than an ordinary snapshot. This information is presented in an entertaining, easily understood, informal, almost breezy style, and contains as much on the experiences and techniques of other camera hunters as the author's own. The book has plenty of excellent material between the covers, but at times a reader might feel frus-

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trated at the organization, either within a chapter or among chapters, because the author often digresses from his subject.

After reading the book, an angler or hunter will gain the impression that more skill is required and more lasting pleasure can be derived from the constant use of the camera than of the rod or gun. In addition, the author emphasizes, no game laws govern camera shooting. The camera user will become a better conservationist, too.

THANE L. BIERWERT

UNION BAY—THE LIFE OF A CITY MARSH

- - - - - by Harry W. Higman and Earl J. Larrison

Univ. of Washington Press

THE theme of *Union Bay* is the ecology of a half-mile-square marsh in the midst of the city of Seattle and on the edge of the University of Washington campus. The marsh forms a spectacular setting for Mount Rainier in August, when the bloom of loosestrife turns it purple. In spring it is a favorite spot for wooing and canoeing, and the channels dredged through it make it an accessible aquatic botanical garden. Its native plants are supplemented by a variety of "escapes." They have been air, water, and steamship borne, since a ship lane passes through, and residential gardens and an arboretum are near by. The fauna is also diverse.

Yet with all these elements of romance, the book falls far short of the mark set by *Pilchuck—the Life of a Mountain*, an earlier work by the same authors. The tone is that of a technical address, and where it attempts to be popular, it is frequently so lacking in directness and simplicity that it misses altogether.

In *Pilchuck*, a vein of rich human understanding, combined with a fictional approach and thorough knowledge, make a delightful combination. While *Union Bay* is equally authoritative, the human touch is so remote that one individual frequently mentioned is never referred to by name but merely as the canoe house manager throughout the book. This is in marked contrast to the nicely drawn characters Doc and Merle used in telling Pilchuck's story.

DEAN FREIDAY

JOHN BURROUGHS' AMERICA

- - - - - - edited by Farida Wiley

Devin-Adair Co.,
$4.00, 304 pp., 26 illus.

FEW people today take time to read 25 books by one author in one field, so it is a service that the gist of John Burroughs writings should be gathered into one readable volume. The genius of Miss Wiley's editorship is that she presents a well-constructed, continuous story built with quotations, and she sets a high standard in the field. Through various kinds of natural history observation—rocks, the seasons, maple sugar days, birds' nests, and so forth—a climax of expressed appreciation of nature is reached: "faith in the essential veracity of things."

The Burroughs books have long been out of print. The fact that this reviewer was "non-Burroughs" and is now pro-Burroughs, attests to the efficacy of this new publication. So early a naturalist had to do all his own observing, and this adds freshness to his home discoveries. Burroughs is our American Gilbert White. The fact that Burroughs' prose is not always distinguished, even though in some ways he outranks Thoreau as a naturalist, means that gleanings bring his best foot forward. And his best is wonderful.

Quotations will give the reader more than descriptions:

"Nature does nothing merely for beauty . . . The perception of cosmical beauty comes by a vital, original process—a creative act."

"The very bird is a symbol . . . the music of nature is not confined to sweet sounds."

"Nature is always new in the spring, and lucky are we if it finds us new also."

". . . there was live natural history under every stone about us . . . the naturalist finds his pleasures everywhere."

Francis Lee Jaques instills into his drawings the freshness of Nature that never tires. He feels this freshness and translates it into black and white.

GRACE E. BARSTOW MURPHY

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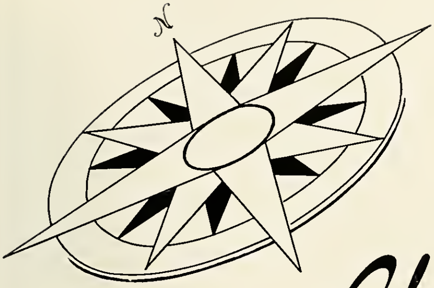
American Museum of Natural History
New York 24, N. Y.



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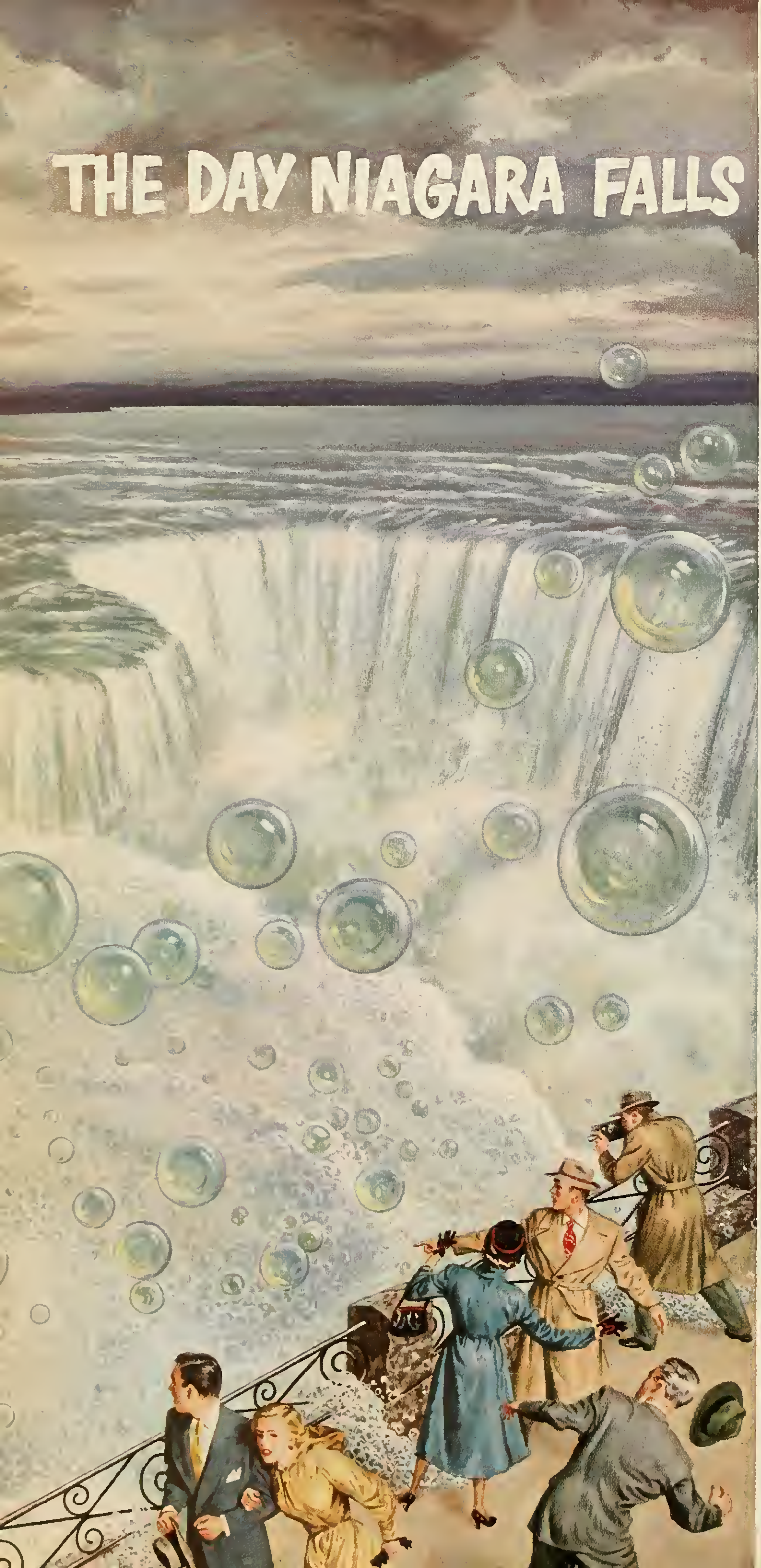

THE DAY NIAGARA FALLS bubbled over

It began suddenly that morning of April 1.

FLASH: NIAGARA RIVER BELOW FALLS COVERED WITH SUDS LIKE WHIPPED CREAM A YARD THICK. (CORRECTION TO EDITORS) NOW TEN YARDS THICK!

The boys on Goat Island emptied the last of their stolen drums of Santomerse No. 1 into the river above the cataract.

MAID OF THE MIST SIGHTSEEING BOAT HAS DOCKED SAFELY. ALL PASSENGERS HAVE FOUGHT WAY TO TOP OF GORGE IN A CLOUD OF BUBBLES.

One youngster on Goat Island grinned to the others, "Boy, this'll be the biggest April Fool joke on record."

GORGE BUBBLING OVER. SUDS BACKED UP TO HORSESHOE FALLS. DOWN RIVER, WHIRLPOOL LOOKS LIKE A GIANT WASHING MACHINE. CAUSE STILL UNKNOWN.

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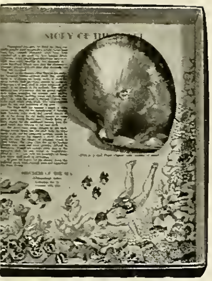
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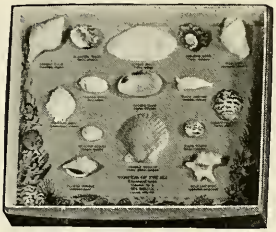
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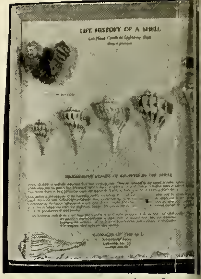
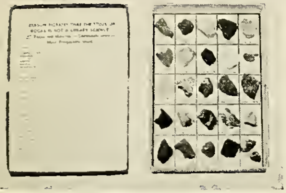

Life History of a Shell



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LETTERS

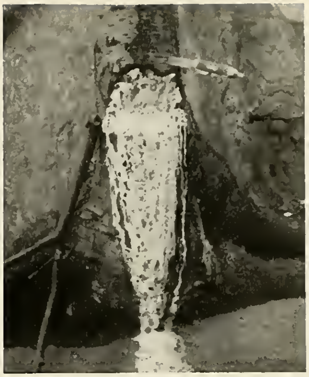
Nature's Sapsicles

Sirs:

Occasionally, as a relief from the daily routine of a busy office, I wander through the hills, woods, and swamps of Van Cortlandt Park (Bronx) for the relaxation that natural history observation affords me. I wonder how many of your readers have ever seen these two small signs of spring that I photographed in Van Cortlandt Park on one of my walks. The first is a "sapsicle"—a term I coined many years ago (undoubtedly others have used it, it is so obvious). A broken twig on a sugar maple tree, a frost, and lo and behold—you have a frozen, tasty morsel. The greatest concentration of flavor is at the drippy end, where evaporation concentrates the maple syrup. Try them sometime—very refreshing. Similar "sapsicles" also occur on injured walnut, beech, and birch, each of which has its own distinctive and delightful flavor.

The second photo also from Van Cortlandt Park shows the sap running from an ax injury on a small black birch tree.

Evidently some overenergetic disciple of George Washington had tackled this cherry birch (as it is also known), and a fairly rapid flow started. A yeast-mold spore must have landed on the syrupy wintergreen-flavored sap flow, and the whitish color is the enormous amount of mold colony that grew. A very active fermentation was in progress, and CO_2 bubbles were being released as I watched. A pleasant odor not unsuggestive of fermenting grape mash filled the air. Plucking up enough courage, I tasted the mess (in the interests of science, of course); and sure enough, the black birch wine had enough alcohol in it to leave no doubt as to how the primitive races may have discovered the art of controlled fermentation. A few staggery, mildly inebriated bee flies were trapped in the gooey fluid.



Disciples of Bacchus seem to range from the low to the high in the animal kingdom.

Theodore Kazimiroff

Bronx, N. Y.

Brotherhood

Sirs:

. . . Your editorial for Brotherhood Week is one of the most compelling I have even seen. . .

Marilyn Kaemmerle,
Secretary

The National Conference of
Christians and Jews,
New York, N. Y.

Sirs:

You did a marvelous job for us. . . You have earned the thanks of our entire organization. . .

Everett R. Clinchy,
President

Brotherhood Week Committee,
New York, N. Y.

Sirs:

We read your editorial on Brotherhood last night . . . and were all stirred by its simplicity and the nonsentimental way in which it conveyed a point so tremendously needed. . .

Esther Everett Lape

Westbrook, Conn.

Sirs:

I always enjoy and admire Natural History, but I wish to express special appreciation for your February issue with its editorial on Brotherhood Week.

Howard Zahniser

The Wilderness Society,
Washington, D. C.

Time to Save the Eskimo?

Sirs:

"Is there Time To Save The Eskimo," by Philip H. Godsell, is one of the best articles I have read in your Magazine, or in any magazine, for a long, long time. It certainly shows what the white man is doing not only to the Eskimos and the Indians but also to the yellow man in Asia and the Negro in America. Retention of an "inferior" race for the sole benefit of the white man will ultimately end badly for all concerned. . . .

Mrs. William Hass

Outlook, Mont.

Sirs:

. . . The article on the plight of the Eskimos was pointed up most vividly. Is there anything that a private citizen can do to help in this deplorable situation? . . .

Frances R. Johnson

Denver, Colo.

Sirs:

. . . I should like to offer a few comments on the part of Mr. Godsell's article that refers to caribou.

Mr. Godsell indicates that there were 30 million caribou in nothern Canada in 1906 and that since that time they have diminished to 3 million. He also states that further effort might be made to increase their numbers.

There is no doubt that the twentieth century has witnessed a marked decrease of caribou in both Canada and Alaska, but the best figures available for the caribou of the Canadian Barren Grounds differ widely from those in Mr. Godsell's article. The most recent scientific conclusion concerning the caribou inhabiting the country between Hudson Bay and the Mackenzie River, is that in 1900 this group included no more than 1,750,000 animals and that by 1950 it was reduced to about 670,000 animals. There are, of course, other northern caribou in Canada, principally in Yukon Territory, the Arctic Islands, the Ungava Peninsula, and the island of Newfoundland. Taking all these into account, it is doubtful if there were more than 2,250,000 caribou in northern Canada and Newfoundland in 1900 or more than 850,000 in the same regions now.

A. W. F. Banfield of the Canadian Wildlife Service, who was in charge of the Barren-Ground Caribou Study from 1948 to 1950, is the author of a preliminary report, which has been issued by the Department of Resources and Development under the title "The Barren-Ground Caribou." . . . A much more detailed report has been accepted by the Graduate School of the University of Michigan as Mr. Banfield's doctoral thesis and is now being considered for publication.

The Barren-Ground Caribou Study has been placed on a continuing basis, in order to provide the Administration with a continual flow of the data required for scientific management of Canada's stock of these caribou. The importance of these animals to both aborigines and white residents in northern Canada is fully realized, and the legislative structure that provides for their protection and management is under continual examination. It is adjusted from time to time as may be required to keep it in harmony with our increasing supply of scientific information on the subject and with changing conditions.

HARRISON F. LEWIS,
Chief

Canadian Wildlife Service,
National Parks Branch,
Department of Resources and
Development,
Ottawa, Canada

SIRS:

I am interested in your article on the Eskimo. Is there no division of the UN that tries to protect the Eskimos and other weak and primitive peoples from the missionary and the trader? There is but little difference between these two groups. The work of both results in the destruction of the native cultures. The primitive cultures are fast being destroyed all over the world to the great loss and hurt of the world at large. Surely among the numerous international bodies that we have today there is one that will fight for the lives of these people.

I applaud your efforts, sir, and wish you success in them.

A. P. WICKHAM

Tryon, N. C.

Answer:

There seems to be no division of the UN set up for the protection of primitive peoples. However, in areas that come under UN trusteeship (as in the case of New Guinea) or in territories that are non-selfgoverning (as in Greenland), the natives are protected in the same way as are others in those lands.

We doubt that protection in this sense comes close to coping with the forces that bring about physical and economic decay in a primitive race exposed to civilization as discussed in Philip Godsell's article.—ED.

Cut or Let Grow?

As this goes to press, the voting of our readers on the question of whether larger areas should be set aside for protection in our National Forests is: 97% in favor of establishing wider areas of preserved forests; 3% in favor of cutting timber at about the present rate.
—ED.

For continuing as at present:

SIRS:

. . . Don't you think it will pay you and me to continue the Forest Service as our Manager? They do not allow the logger to drag the logs out at will. Logging trails and roads are laid out for the logger so as to destroy as few small trees as possible. The waste is piled and burned in the safe season. They guard our Forest against fire. . . I am glad the Bureau of Internal Revenue is not running our Forests. I spent a summer near the mouth of the Salmon River in Idaho, known as the "River of No Return." It drains the largest primitive area left in the U. S. I hope it remains that way. It is needed for posterity.

K. N. DAHLE

Coconut Grove, Fla.

For wider preservation:

SIRS:

I have followed with dismay your unsuccessful effort to elicit from the United States Forest Service a statement of a constructive attitude toward the National Forests, and I agree with you that the letter from Mr. Parkinson is a classic in courteous evasion.

Obviously there is no meeting of the minds here, and I hope that your periodical will continue to use its influence in the direction of changing the policy of the Forest Service from production to conservation.

KARL A. MENNINGER, M.D.

The Menninger Foundation,
Topeka, Kans.

SIRS:

. . . In my opinion we must do all we can to save our National Forests. I have seen the damage done here in Michigan due to unrestrained cutting and know the forests have not come back. . .

D. F. WALLACE

St. Joseph, Mich.

SIRS:

Congratulations on your article "Cut or Let Grow" and for inviting comments from your readers on a very serious state of affairs.

. . . One knows pretty well what a cut-over area looks like, even if only the "mature" and "decayed" trees are sawed. But the destruction does not stop there: the land is leased for grazing. This removes seedlings and small growths, exposing the humus to baking sun and pouring rains. Heavy erosion follows, and in a few years a primitive forest is thus converted into a dust bowl.

We are assured that a fringe of trees will be left along the concrete highways and that some timber that is remote and inaccessible, will not be cut.

The destruction (one infers) is ordered by the political machine: it wants the money, it wants the votes of the lumberman and the cattleman and the associated industries in the States where National Forests are situated.

. . . The Forest Service cannot escape its responsibility. It has betrayed its trust. Logically the Service should be abolished. The National Forests should be placed in the care of some body like the Smithsonian Institution which the political machine has not been able to corrupt and which is responsible to Congress.

If we would save the remaining fraction of our National Forests, we must act quickly and forcefully. One has but to look at a map of the eastern Mediterranean to see what will happen. Palestine, Syria, Lebanon, Turkey, and Greece were all once forested lands, where the trees were logged, where grazing followed; erosion resulted in complete loss of humus, and the bare, baked soil will hardly grow a one-third crop. Our rich, primitive forests will be reduced to this kind of poverty-stricken land, unless we act at once.

CONRAD CHAPMAN

Boston, Mass.

SIRS:

I heartily endorse any inquiry that would put a stop to our various bureaus that run rough-shod over my idea of conservation. The U. S. Forest Service bureaucrats are not a wit different than are the Army Engineers and the Bureau of Reclamation. Each one was conceived for one basic purpose, yet all three have taken on the God-Given Privilege of doing whatever they choose wherever they choose to do it. . .

CARTER H. HARRISON, JR.

Chicago, Ill.

SIRS:

Please do continue your good work relative to the preservation of our Forests. I often wonder if our State and National Conservation Departments should not have their names changed. We would then be able to understand their function better.

HELEN R. BRAEM

Mt. Kisco, N. Y.

SIRS:

. . . I do wish the politicians, lumbermen, etc. would leave our National Parks and Preserves alone. . .

ESTHER KARST

The John Karst Historical
Home Museum,
Sullivan County, N. Y.

SIRS:

. . . I believe in conservation and have contributed to "Save the Redwoods." I think forests should be cut to remove trees that have reached maturity or are on the decline, except for some

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Alexander M. White, President
Wayne M. Faunce, Assistant Director
In charge of Publications
Albert E. Parr, Director

VOLUME LXI—No. 4
APRIL, 1952

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You will find Natural History Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

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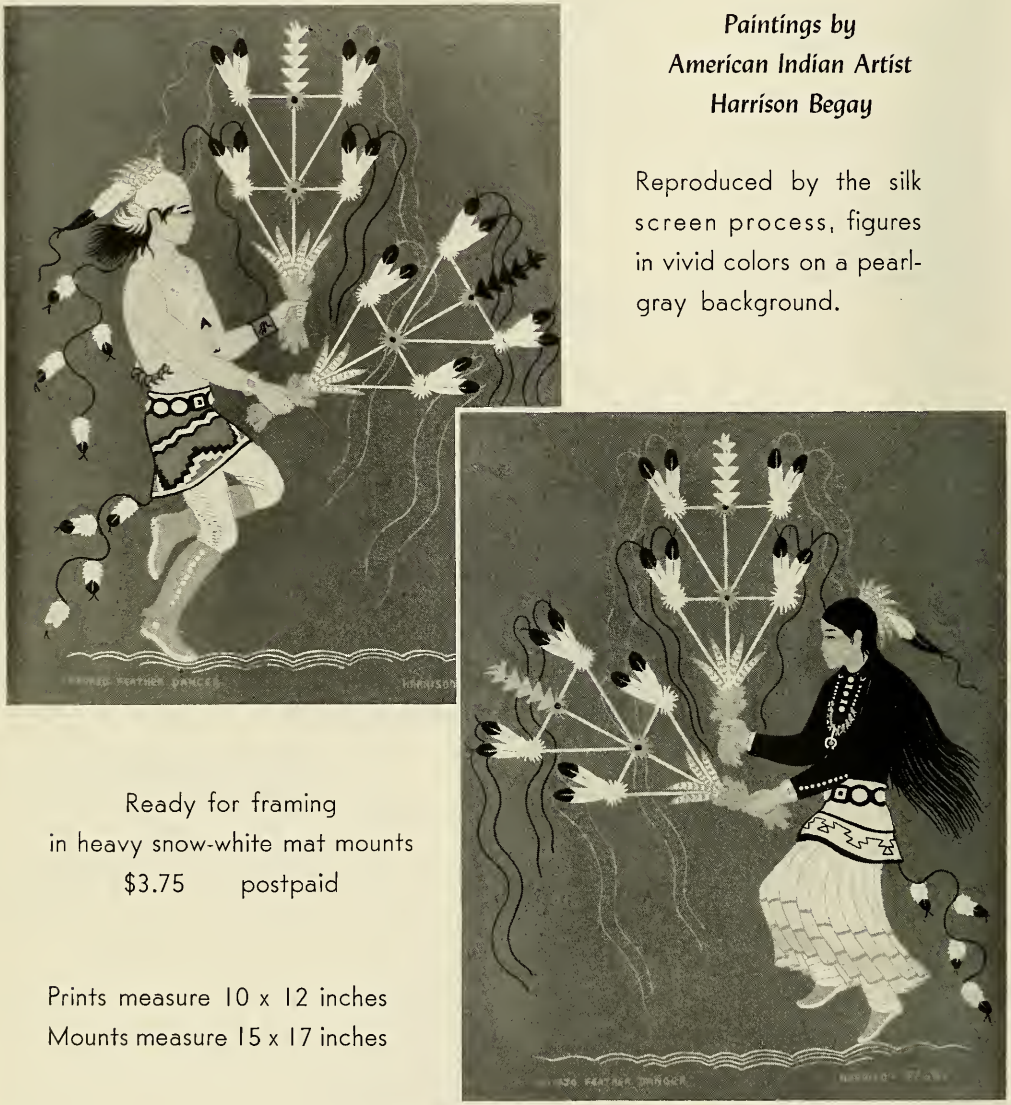

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Lowell Thomas: Back to Mandalay • Birds
Audubon • Shalimar • Amphibians

HUDSON'S BAY TRADER

- - - - - - - - - by Lord Tweedsmuir

W. W. Norton, $3.00
195 pp., 16 illus.

THIS is a diary of the year 1938-39 spent at the Hudson's Bay Company post at Cape Dorset on Baffin Island. Chesley Russell and the author, the son of the late Governor-General of Canada, staffed that isolated post that winter and obviously enjoyed the country and their Eskimo neighbors. The supply ship "Nascopie" landed them at the post in late July, along with a winter's supply of trade goods and a new dwelling house to be erected. During the summer and fall they finished the house, freighted coal from an abandoned company station at Amadjuak Bay, and hunted walrus in the small schooner attached to the Dorset post. After considerable hard work and a series of misadventures in rough seas, they secured a year's supply of dog food. Hunting seal, hare, and ptarmigan occupied the weeks until the sea froze over early in November, and then the serious work of the winter began. In addition to trading with the Eskimo for fox skins, the two men ran trap lines, taking turns visiting their sets with their dog team.

While the dark northern winters seem to pass rapidly, the days do become monotonous, so when the daylight returns people are restless and like to travel. In April, Lord Tweedsmuir made a sled trip down the coast to the nearest company post at Lake Harbor. After returning from that he made another journey with his Eskimo companion, Otoochie, to the Fox Channel coast northwest of Dorset to investigate a reported deposit of asbestos. They found the deposit, but it was so small that it had no commercial possibilities.

In May, open water appeared and seal hunting was resumed. At this time of year seals can be shot while either swimming or sleeping on the ice. The loons, eider ducks, and geese arrived in June and provided a welcome variety to the menu. The early summer passed rapidly for the two men who were principally engaged in working about the post. The "Nascopie" arrived in late July, and the author boarded her with considerable regret.

This is an account of small daily happenings and observations rather than a story of great adventure, and it gives a pleasant and honest picture of life in the Canadian Arctic. Lord Tweedsmuir must be congratulated as an outstanding practical conservationist, for by his own account of his hunting, he actually killed only about one out of every 20 of the animals at which he shot!

James A. Ford

THE ROAD TO SHALIMAR

- - - - - - - - - - by Carveth Wells

Doubleday & Company, $3.75
282 pp., 21 photos, 1 map

KASHMIR, land of romance, is a subject of violent dispute between India and Pakistan; but Carveth and Zetta Wells yearned to visit Dal Lake and beautiful Shalimar, the garden of love. Early in 1950 Carveth was called to Pakistan to help prepare for the visit of Liaquat Ali Khan to the United States. Though charmed with all he saw there, he found no open door to Kashmir.

The pilgrimage of Carveth and Zetta to Shalimar took a roundabout course. In August of 1950 a fresh start was made, by way of Sweden and Lapland. That made for variety, with sundry observations on scenery, socialism, lemmings, and Lapps. All the while, wires were being pulled to obtain entry to Kashmir. The trip from Norway to Calcutta by air takes only three days, and with the aid of Ambassador Henderson the Wellses were crossing India before autumn really began. A breezy account of their travels is packed with comments on social conditions and historic edifices; some details are anything but appetizing.

The plane to Srinagar was piloted by turbaned Sikhs; and from the air the Vale of Kashmir appeared truly an emerald set amid pearls, a lovely green valley surrounded by snowy peaks. Next came an amusing holiday on a Dal Lake houseboat, one of the few with occupants, and discussions of the future of Kashmir by varied observers. Wells himself offers a novel proposal, to make it an International Park.

Finally Carveth and Zetta realized their dream—visiting Shalimar. This magnificent walled garden, once a favorite resort of Moguls, has a backdrop of rugged, snow-capped mountains. From Srinagar an American military plane whisked them out across the cease-fire line. Carveth Wells knows all the ropes

Checklist for Naturalists

✓ **SEARCH for the SPINY BABBLER**

A Naturalist's Adventure in Nepal by DILLON RIPLEY.

"As for the readers who are ornithologists, I imagine that this is already the best book of 1952, and 320 days still to go." John Hutchens, N. Y. Herald Tribune
$4.00

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and provides a sprightly book. He has his prejudices, but he is a wondrous storyteller.

JAMES P. CHAPIN

BACK TO MANDALAY

- - - - - - - - by Lowell Thomas

Greystone Press, $3.50, 320 pp.

THIS book tells of military operations in Burma at the time of high flood by the Japanese forces. The Japanese pressure was successfully contained and the tide turned, as we all know today. But the clever planning necessary and the endurance and fortitude required to accomplish this is not so generally realized. General Wingate of the British Army, with the cooperation of detachments from the American Air Force, accomplished miracles in long-range maneuvers over difficult terrain. Lowell Thomas, in concise, forceful passages, describes the stirring episodes of Wingate's campaign.

General Wingate and the leaders of the American group began their association on a note of mutual distrust. This was dispelled upon better acquaintance and appreciation of what was being pooled in the joint undertaking.

The Japanese lines were vulnerable to guerrilla warfare, but distances were too great and terrain too difficult for small and scattered bands of foot soldiers to be a menace. Planes with gliders in tow brought a new concept into guerrilla warfare. Now the mobile forces carried the punch of a heavyweight, carried it far, and turned up at unpredictable places.

Much of the story is told in the words of the principal actors on the scenes. These quotations convey an air of authority and usually speed the action, for they come right to the point.

The publisher's blurb on the jacket calls this book "one of the great adventure classics of modern times." The reader will not question the adventure, the book is nothing but. However, the over-all impression is scarcely that of a classic, except as Hollywood might use the word. The style is journalistic, in the modern tempo, with comic-strip chapter headings. The masses probably like their adventure seasoned in this fashion; for those who do not need the ballyhoo, the story carries adventure in its truest sense.

HAROLD E. ANTHONY

CURIOUS CREATURES

- - - - - - - - - - - by Erna Pinner

Jonathan Cape, London, 12/6,
256 pp., 154 illus.

A CURIOUS animal, according to strict dictionary definition, is one that is strange or rare. Not all the creatures that appear in Miss Pinner's book are rare, but the appearance of a good many of them is unusual and the behavior of many of them is quite strange. There seems to be a trend in popular natural history writing to exploit the bizarre and freakish aspects of nature. There is no sin in thus expounding the wonders of nature, but this reviewer sees two dangerous effects of accenting only the strange.

First, the layman, who ought to be firmly grounded in good natural science, gets the unusual rather than the usual picture of nature, and this diet of the sensational and queer may distort his attitude toward natural history. The aspects of nature that are interesting are not always sensational, and there is much to write about that need not involve only the curious creatures. In the second place, unless a writer is a good outdoor zoologist, he runs the risk of seeing nature entirely through someone else's eyes. He is then limited to library sources, and if he does not carry on his "exploration" carefully and check all his items thoroughly, he may only be perpetuating previous errors some of the time.

For the most part, Miss Pinner has been careful in regard to the authenticity of her material. However, the Great Horned Owl, which she calls the Great Horn Owl, is not a rare and strange creature, nor is its behavior unusual. In another instance, the author deals with the Cattle Heron and the Buffalo. She writes of their "digging out from the hides of their gigantic partners such parasites as ticks and warble-flies." These birds may occasionally feed on a tick, but their chief diet consists of grasshoppers, and the birds use their mammal associates mainly as moving perches.

The illustrations are by the author and, for the most part, are well executed. Looking at some of the drawings of mammals and birds, however, one gets the feeling that drawing feathers and hair is not one of Miss Pinner's fortes. The book covers a wide range of creatures from all over the world and should excite and interest the layman. In a book covering such a wide range, however, we would have felt better if the author had cited her sources for some of her information. We can only hope that she has not succeeded in making any of her subjects more curious than they actually are.

JOHN R. SAUNDERS

INSECTS IN YOUR LIFE

- - - - - - - - by C. H. Curran

Sheridan House, $3.50, 316 pp., 29 illus.

HERE is a volume that deals with a variety of common animals, mostly insects, with which one might have a passing or active acquaintance in the home, the field, and the woodland. It is written in a readily readable style, which the layman will enjoy, and it is on a subject from which anyone can glean numerous useful facts. Several chapters deal with the economic relationship between man and insects.

Dr. Curran has drawn upon his extensive professional experience to put before the reader information about the life histories of some destructive pests and methods of controlling their ravages. Several kinds of carpet beetles and clothes moths, together with silverfish, webworms, and springtails are discussed. The truth about termites is revealed; and there is a separate section on ticks and human welfare. A separate chapter deals with DDT, the value of this miracle chemical and the dangers involved in its use. There are several chapters on special topics that should be of general interest to every reader. In one such, the author tells about Nature's gyroscope, the halteres. He explains how these structures are integral parts of an insect's body, how they aid the insect in flight, and how knowledge of them led to a better understanding of the mechanics and principles of balance. In another, Dr. Curran tells the story of the woolly bear caterpillar and narrates how observations on this insect led him to support the age-old contention that the kind of winter season can be foretold by examination of this caterpillar's colored bands. If the reader is interested in knowing whether insects are ever used as food, the chapter on "Eating Insects" will be found intriguing.

The volume concludes with a discussion of some insects from Barro Colorado in the Canal Zone and the importance of insects among the aborigines of America.

HERBERT RUCKES

UP THE MISSOURI WITH AUDUBON: THE JOURNAL OF EDWARD HARRIS

edited by John Francis McDermott

University of Oklahoma Press, $3.75
222 pp., 12 illus.

WHEN John James Audubon made his last voyage of exploration, that to the upper Missouri River, he was accompanied by a young gentleman-farmer, Edward Harris of Pennsylvania. Harris acted as treasurer of the expedition, to which he had contributed generously himself. Audubon named a number of birds for his friend, in particular Harris's Sparrow, of which Harris shot the first-known specimens during this 1843 trip with Audubon.

In his journal, Harris recorded the daily experiences of the party with the savage animals and Indians and nearly as savage white adventurers and hunters who roamed the western plains in those days. Buffalo hunting was at its height, and this journal is noteworthy for its authentic descriptions of this important chapter in frontier life. Harris engaged strenuously in this activity and was soon adept at reloading and firing a muzzle-loading rifle while astride a horse galloping at full speed in pursuit of the fleeing bison. But he did not join the professional hunters as they avidly ate chunks of raw Buffalo liver and "manifold" (tripe) dipped in the warm blood of the freshly-slaughtered beast. When a local official cooked an Indian puppy for them, Harris wrote that ". . . as I did not feel very well, I let it pass this time," but "Mr. Audubon declared it was equal to young Pig and ate quite heartily of it." Perhaps because of his squeamishness, Harris lost 25 pounds during this trip and had to rest in the South for some time before returning East to resume his orderly existence as local squire and modest patron of science.

This is a fine book in every respect: well produced, finely illustrated, and edited by an authority on the history of the region and period.

D. AMADON

AMPHIBIANS OF WESTERN NORTH AMERICA

- - - - - - by Robert C. Stebbins

University of California Press, $7.50
539 pp., 35 figs., 64 pls., (5 in color)

HANDBOOKS are becoming expensive. But while they have increased in price, they have also increased in quality and coverage. This book deals with the frogs and salamanders found in western North America, from New Mexico northward to the Mackenzie in Canada and westward to California and Alaska. In this vast area there are but 22 species of salamanders and 29 frogs and toads, including two introduced from the east. Since over 500 pages, exclusive of a glossary, bibliography, and index, have been devoted to accounts and depictions of these 51 species and their subspecies, it is manifest that each has been treated in considerable detail.

The author is a competent investigator as well as a teacher, a naturalist, and an artist. This fortunate combination of abilities has resulted in a book that has been carefully planned and thoroughly and intelligently illustrated. Every species and subspecies in the area covered has been depicted, with three toads and several of the gaudier salamanders shown in five color plates. The eggs and the larvae are illustrated, and text figures show pertinent details of structure mentioned in the text or in keys. Technical terms are used, not unwisely, in descriptions but explained in the glossary or in diagrams. Maps, the most accurate thus far published, delimit the ranges of all the species treated. Reproductions of 23 photographs illustrate representative habitats.

The text describes not only the animals, their eggs, and developmental stages, but their habitats, habits, modes of reproduction, and behavior. For more than a decade the author has scoured western mountains, foothills, and valleys in his efforts to fill in gaps in the record, and his book draws amply from personal knowledge.

Dr. Stebbins' efforts, his ability, and his patient attention to detail, not to mention his enlightened interpretation of the information obtained from many sources, are all reflected in the general excellence of the book, doubtless the best available for the region. While it does seem expensive, it's undoubtedly a better bargain than the older handbooks that provided only a fraction of the information at half the cost in good "pre-war" dollars.

C. M. BOGERT

YOUR HAYFEVER AND WHAT TO DO ABOUT IT

- - - - - - - - - - - by Harry Swartz

Funk and Wagnalls, $2.75
182 pp.

IF you are one of "those millions throughout the world afflicted with hayfever," this little book is dedicated to you and your fellow sufferers.

The book is divided into 16 chapters, each containing comprehensive answers to the questions that experience has shown a hayfever sufferer is most likely to ask. Among these topics are: the history of hayfever; what is allergy?; the pollens and what they do; escape from hayfever; rules for seasonal hayfever victims. A chapter is devoted to each of the various types—spring, summer, fall, and nonseasonal hayfever.

Though some of these are highly technical subjects, they are discussed in simple language and in an entertaining style, so that no more than an intelligent interest is needed for their enjoyment.

The point is emphatically made that if you have hayfever, the thing to do is to take the specific hyposensitization by subcutaneous injection of an extract

Continued on page 192

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Marine Studios blazes the trail in the study of porpoise psychology

and produces a star performer

FLIPPY
the educated porpoise

By John W. Dillin

Director, Public Relations, Marine Studios

Photographs by Kurt Severin

unless otherwise credited

DISCUSSING the accomplishments of Flippy, the trained porpoise under observation at Marine Studios, Marineland, Florida, someone commented:

"If Flippy gets any smarter, he'll be talking."

To which Adolf Frohn, Flippy's trainer, replied, "He does talk, but we aren't smart enough to understand him."

While Mr. Frohn meant this as a quip, it has foundation in fact. Porpoises are capable of making a wide variety of sounds including jaw clapping, whistling, chirping, squeaking, and the drawn-out grating noise of a rusty hinge. All are made underwater, and some are loud enough to the human ear to be heard at a distance.

Once when a mother and daughter porpoise were separated in the oceanarium of Marine Studios, there were definite signs of communication. They had been temporarily placed in separate tanks with a shallow connecting flume between them. Throughout the separation, the younger animal whistled persistently, and the mother, although she could not see her offspring, frequently answered while remaining close to the gate of the connecting flume.

This and other characteristics of the porpoise suggest the question: Just how much can these fishlike mammals be taught?

In 1947, the late Arthur F. McBride, Curator of Marine Studios, and D. O. Hebb of McGill University and the Yerkes Laboratories of Primate Biology, Orange Park, Florida, collaborated on a study of the behavior of captive porpoises. Among the problems they considered were ways of determining the relative intelligence of these animals. It was known that the subjects of their investigation, the common bottle-nosed dolphin, or porpoise, *Tursiops truncatus*, has a brain larger than that of a man. It had also been reported that the convolutions of this brain are more marked than in man. But, of course, it cannot be assumed on the basis of these features alone that psychological development is at a corresponding level.*

As McBride and Hebb pointed out, the word "intelligence" has never been defined to the satisfaction of everyone, and consequently there are no generally agreed-upon tests or criteria by which the mental capabilities of animals (including man) may be compared and rated. However, at the conclusion of their study they pointed out that the porpoise, so far as certain aspects of his behavior are concerned, appears to fall somewhere in the range of development between the dog and the chimpanzee—in other words, at a rather high level.

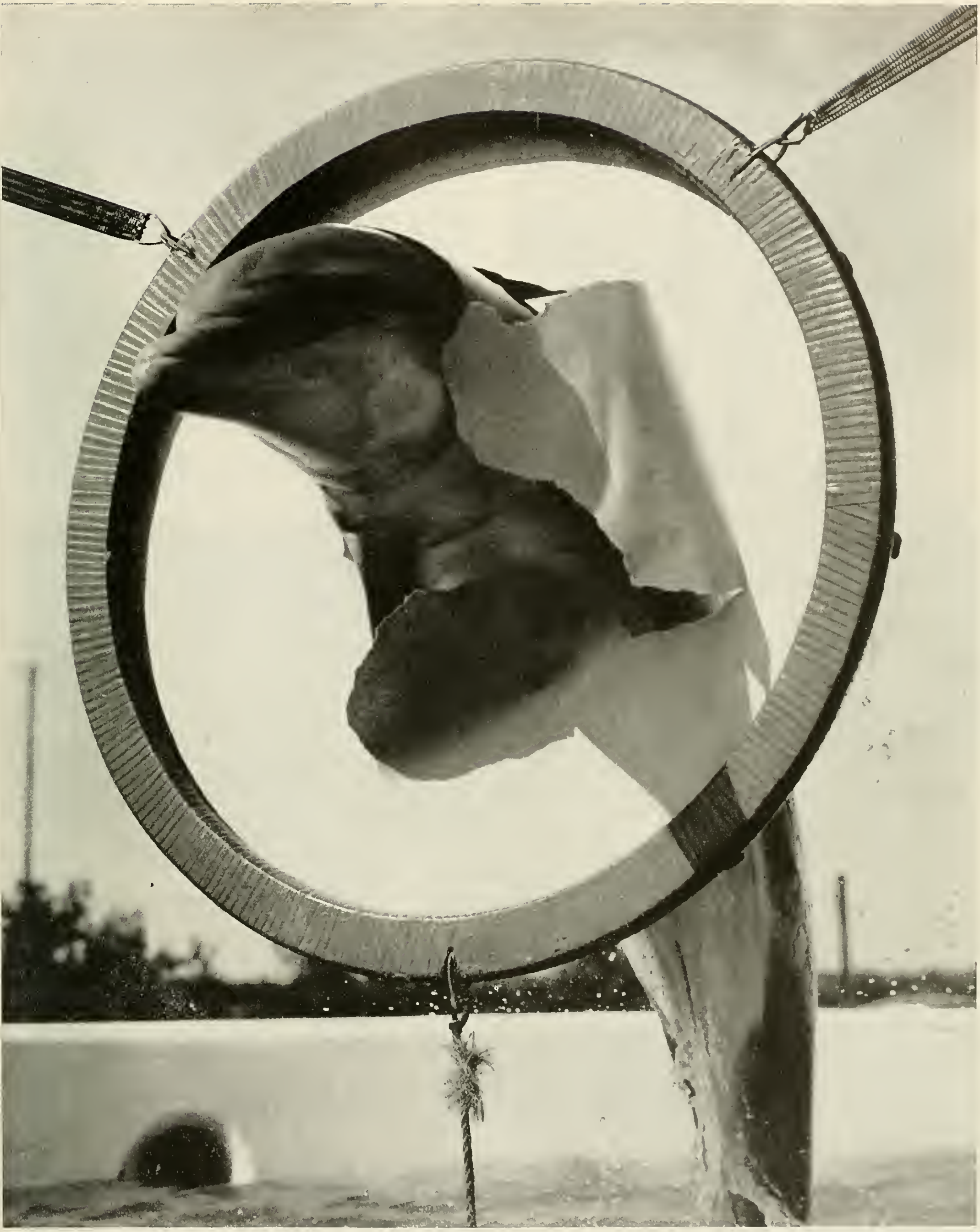
Within the past year, further evidence has been obtained to substantiate these findings as the result of a project undertaken at Marineland to determine the extent to which a porpoise can be trained to obey commands. In this respect, at least, Flippy, the animal selected for training, has exceeded all expectations.

Flippy is a member of one of the 22 species of small-toothed whales found along the Atlantic and Pacific coasts of North America. Although properly called dolphins, Flippy and his kind are commonly referred to as porpoises. Bottle-nosed porpoises have been successfully maintained at Marine Studios for a number of years and have even conceived and borne young in their giant oceanarium home. It was only natural that a member of this species should be selected for what were to prove some very popular experiments.

Flippy had been captured in an inlet by means of a net blocking his escape. Estimated to be about two years old, he weighed approxi-

---

* Actually, one has to consider the relation of brain weight to the animal's total weight. The extent of the convolutions indicates the area of cortex (the outer layer of gray matter) in relation to the rest of the brain. But they may be less important than the *organization* of the cortex, so far as intelligence is concerned. Here the brain of a porpoise and the brain of an ape are quite different, the porpoise apparently lacking the frontal association area.



▲ **One of Flippy's** most unusual feats is to leap through a hoop over which a paper is pasted. He breaks the paper with his snout and closes his eyes as he does it mately 150 pounds and measured close to 6 feet.

His name was suggested by Mrs. Cornelius Vanderbilt Whitney, wife of the Chairman of the Board of Directors of Marine Studios. To anyone who has ever seen a porpoise leaping clear of the water with only a few powerful flips of its tail, the name is quite appropriate.

His first home was a 20-foot tank, which received a constant flow of fresh sea water.

The man selected to conduct the training came from the fourth in that many generations of animal trainers. Adolf Frohn is a native of Germany, and in Europe he had been successful in working with white rats, pigeons, racoons, pigs, pelicans, seals, and sea lions. Prior to coming to Marineland, he had never seen a porpoise. Today he admits he lacked any confidence in teaching a "fish" to do "tricks."

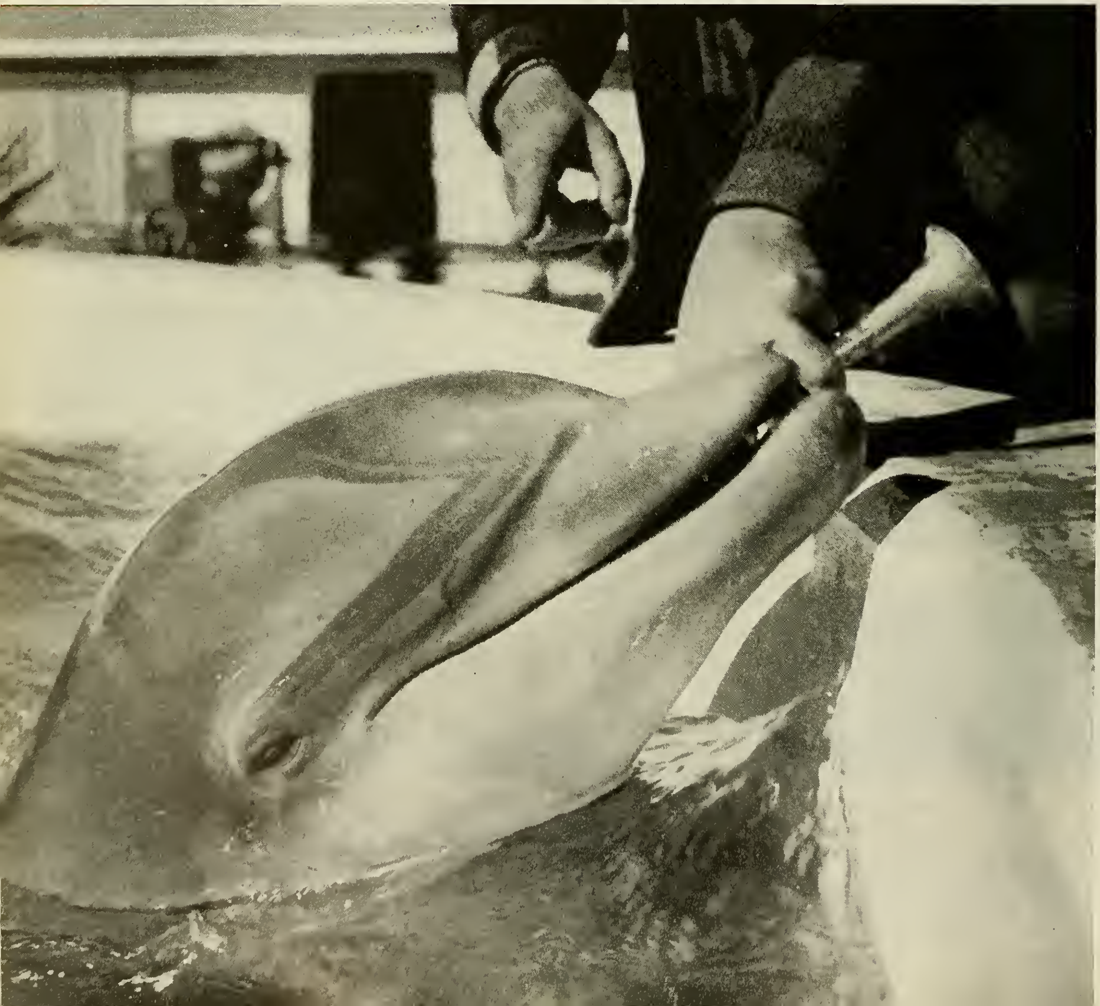
The first step in training an animal is to teach it its source of food. Flippy, like all porpoises, is a fish-eater, and he soon learned that Mr. Frohn was the "fishman." First the fish were thrown into the water of the tank. In only one week, Flippy was taking fish from his trainer's hand. The porpoise ate well from the beginning, and achievement came fast as Mr. Frohn gained the mammal's confidence. In three weeks, the porpoise showed almost full trust and accepted food very gently from his trainer's hand.

From this point in the progressive training program, Mr. Frohn has jealously guarded his secrets of just how he has accomplished the final results. It is clear, however, that infinite patience was a prime requisite. His success was complete, as the porpoise itself will demonstrate with his performances.

Here are some of the accomplishments:

On a signal from hand or voice,

▾ On command, Flippy will honk the horn—gently enough not to puncture the rubber bulb with his teeth



▲ **Getting Flippy** into his first harness required much time and patience. Now he willingly waits while it is fastened

▲ **Flippy** apparently enjoys performing in harness. His bland "smile," however, is simply the natural expression his face assumes when he closes his mouth

▲ **Flippy** became friendly with the fox terrier and seemed to enjoy having the dog lick his sunburned forehead

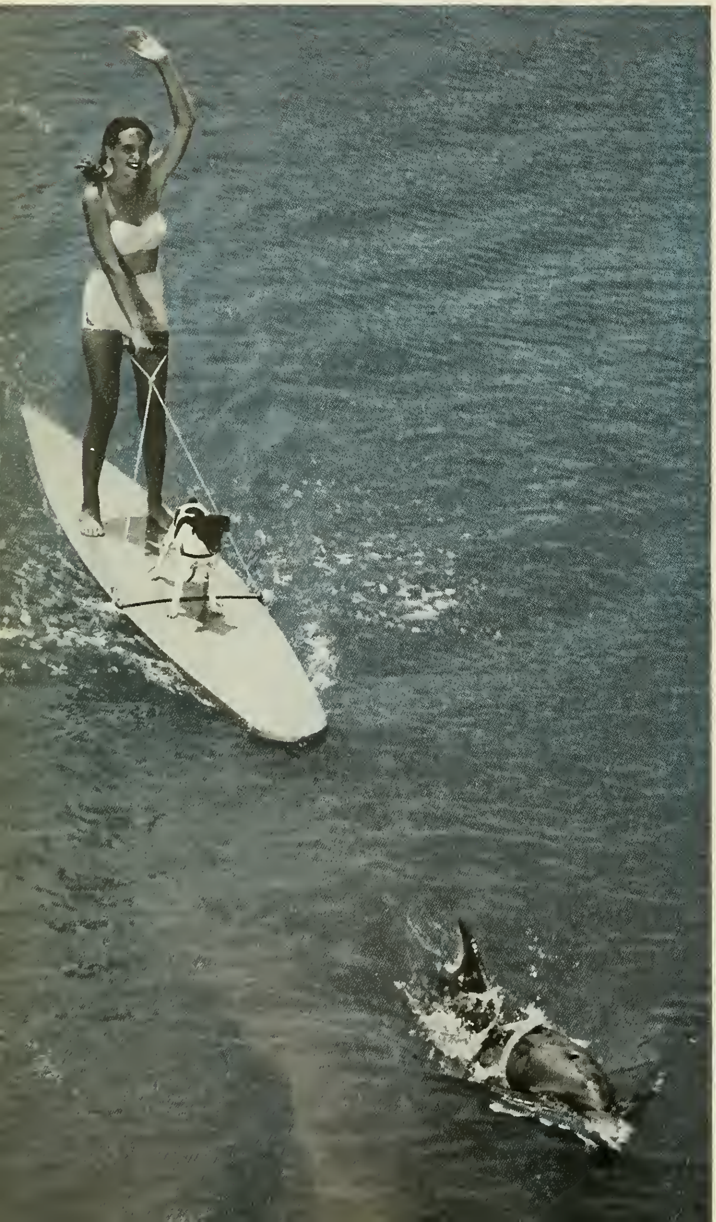


Photo by
Marineland, Florida

▲ THE DOG, in turn, would avail himself of a ride on the surfboard whenever given the opportunity

◄ THE CLIMAX of Flippy's performance

Flippy has been taught to roll over and over in the water. He will continue to perform until Mr. Frohn ceases to command him.

When the trainer throws a stick onto the surface of the water, the porpoise will swim to it, grasp it in his mouth, swim back to the thrower, and deposit it in his hand.

On instruction, Flippy will swim across the tank and raise his full length out of the water to grasp a rubber ball to which a bell is attached. In doing this, he causes the bell to ring. He then releases it, lowers himself back into the water, and returns to be rewarded. In other words, he rings his own dinner bell.

Mr. Frohn holds in his hand a small horn that is honked by a rubber bulb. Flippy will bite it hard enough to depress the bulb but not hard enough to puncture it. He will repeat the performance as long as his trainer tells him to do so.

The dolphin will swim through a hand-held underwater hoop, turn around and swim through it again and again, as he is instructed.

One of his more interesting accomplishments is to sit halfway out of the water and, on each flick of his trainer's wrist, swim a stroke backward with the upper part of his body well above the surface. Upon reaching a halfway point in the tank, he will stop to await a ball thrown to him. Flippy will catch it in midair and then return it to Mr. Frohn's hand.

Teaching the animal to jump out of the water and hurdle an object required more lengthy schooling. Now he will not only jump through a three-foot hoop suspended three feet above the water, but he will leap through it even with a piece of paper pasted over the hoop.

Evidence of his enjoyment in performing is demonstrated when the animal swims into his own harness. Getting the mammal into his first harness required much time and patience and was one of the most difficult tasks undertaken in the program. Once the porpoise learned, however, he voluntarily remained quiet until it was fastened.

Transferred to a lagoon after several months of work, Flippy was introduced to two new partners. One was Mr. Frohn's household pet, his fox terrier. In time they were friends.

In the training program, Flippy had his head out of the water so much that he actually became sunburned. As a treatment, Mr. Frohn applied petroleum jelly. Observing the trainer smoothing the jelly over the porpoise's head, the fox terrier offered its own natural treatment. On several occasions, the dog was observed licking Flippy's sunburn, for which the porpoise held still as though enjoying it.

The dog fitted into the training by being towed on an aquaplane by Flippy.

The second partner was a girl. Once accustomed to each other, the girl would enter the water with the porpoise. From Flippy's harness was a rope which she would grasp, and the porpoise would tow her. He later gave her a ride on a surfboard, and sometimes both the dog and the girl would ride behind the porpoise on the board.

In the November, 1949, issue of NATURAL HISTORY Magazine, Dr. J. Kenneth Doutt, of the Carnegie Museum of Pittsburgh, gave an account of how a woman was caught in an undertow while swimming. Suddenly she was given a tremendous shove and landed on the beach, face down and exhausted. No person in the water was in sight, but approximately eighteen feet from the shore was a porpoise.

A witness informed the woman that the porpoise had shoved her ashore and, what is more, it was the second time that he had seen a person saved in a like manner.

The editor of NATURAL HISTORY pointed out that it would be easy to assume that the air-breathing porpoise was intentionally helping a creature who would drown if deprived of air. But most students of animal behavior, he noted, will prefer to explain the rescue as a result of the animal's natural curiosity and playfulness.

Whatever the full interpretation, the porpoise's inclination to nose a floating object through the water is given some verification by Mr. Frohn's experience in training Flippy. He used a boat in the lagoon to get from position to position. As he endeavored to paddle, the porpoise would push on the boat and steer it, sometimes on but more often off course.

⮝ **FLIPPY** patiently receiving his daily eyewash

➤ **RECEIVING HIS REWARD** after pulling the surfboard around the lagoon

▲ **Trainer Frohn** motions Flippy to ring the dinner bell at upper left

➤ **Following** the signal from Mr. Frohn's hand, the porpoise rises out of the water and "calls for his own lunch"

Incidentally, Mr. Frohn can't swim, yet he spent much of his time in the boat without apparent fear. It might be surmised that he looked upon Flippy as his lifeguard.

During the period of schooling in the lagoon, Mr. Frohn was handing Flippy a fish. Either the porpoise was too affectionate or too eager to receive his food. Nevertheless, Flippy suddenly leaped completely out of the water into the lap of Brother Frohn, who was sitting in the boat. Startled for a moment, the trainer lifted the 200 pounds of wiggling porpoise back into the water.

Just how much further Marine Studios can go to demonstrate Flippy's learning ability, or that of any other porpoise, depends entirely on the ingenuity of the trainer.

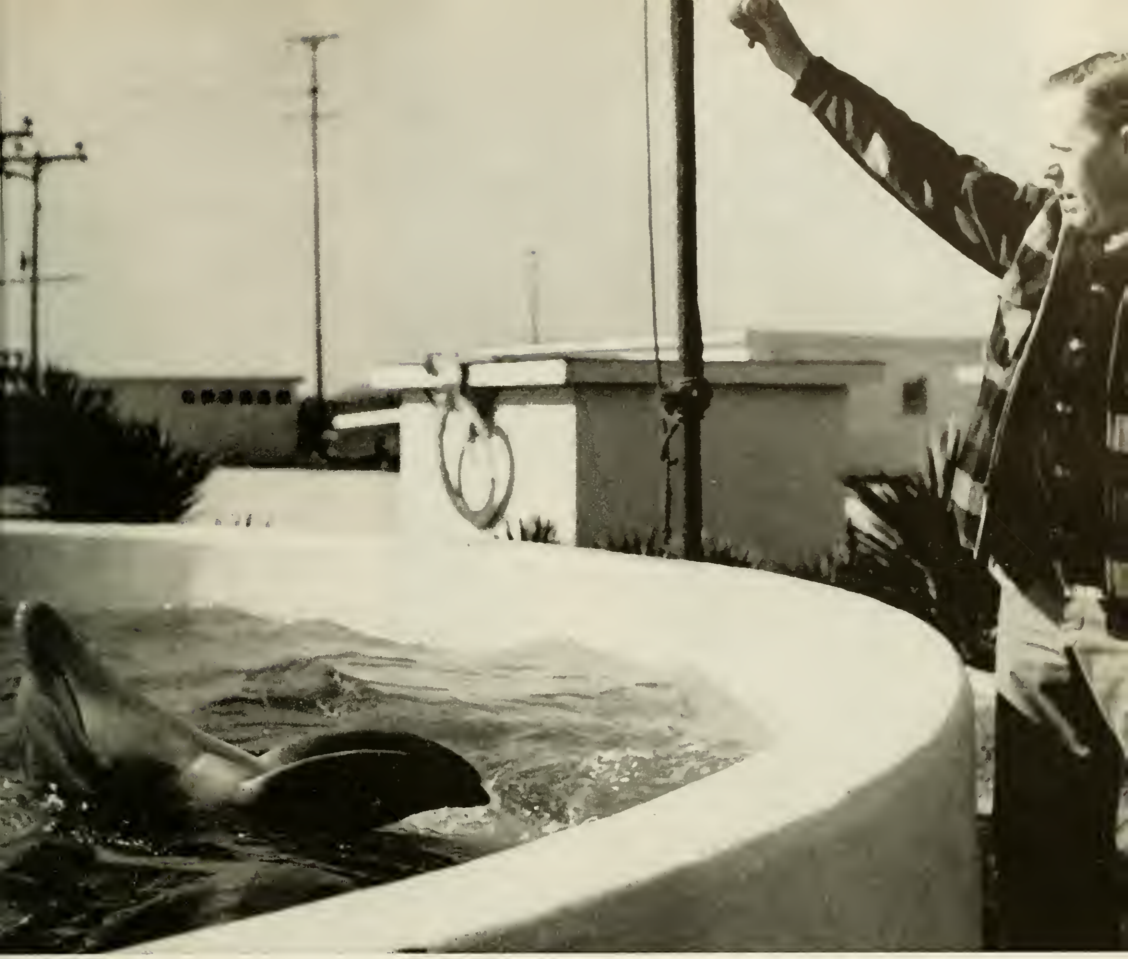
All who have seen Flippy perform concede that he is a genuinely smart animal. However, Mr. Frohn says with commendable scientific spirit, "Actually, he may be a dumb one!" As yet he has had no opportunity to compare this particular specimen with other porpoises, since it is the only one with which he has worked.

Another porpoise is on the future program of Marine Studios. It is planned to obtain a female long-snouted dolphin, or spotted porpoise, (*Stenella plagiodon*), which is an offshore variety.

In the meantime, Flippy's training continues. He is learning now to pull a lanyard that raises Marineland's porpoise pennant to the top of a mast.

This he might be doing as a symbol of raising the porpoise flag over the marine mammal world on behalf of the many porpoises that have become the favorite pets of the seas and in acknowledgment of the great popular interest that has been accorded these animals at Marine Studios during the past fourteen years.

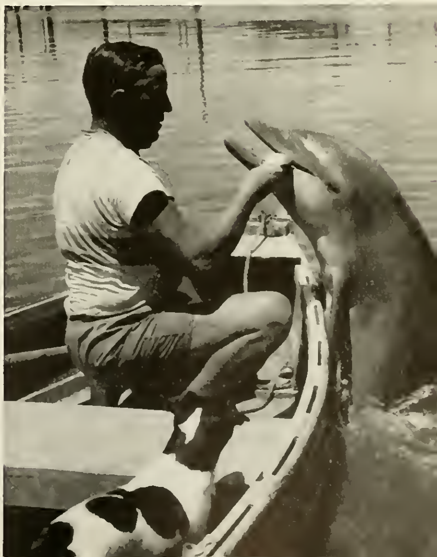
Photo by Marineland, Florida



▲ SITTING PART WAY OUT OF WATER and swimming backward, Flippy waits for Mr. Frohn to throw the ball. Flippy will catch it in mid-air, then return it

◄ THE EDUCATED PORPOISE likes to be petted by his trainer

► VERY GENTLY and without endangering trainer or boat, Flippy takes his reward. Once, however, the porpoise became either too affectionate or too eager to receive his food. Mr. Frohn found Flippy in his lap and had to lift the 200 pounds of slippery porpoise back into the water



Wings under water

By Tom McHugh

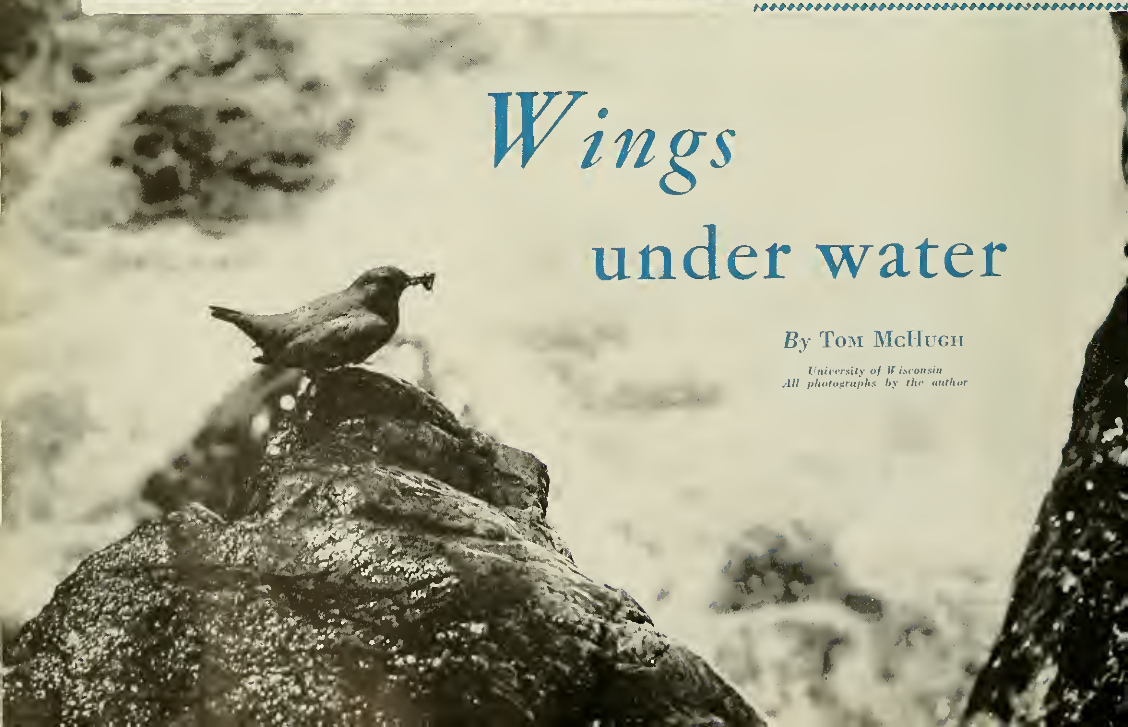
University of Wisconsin
All photographs by the author

THE spray from the pounding waterfall enveloped everything. It gathered on my plaid shirt till the dye dissolved out and tinted my skin red; it condensed on my camera and fell in droplets into the pools below; it covered the camera lens and transformed the image on the film into a blurry ghost; it swelled the algae on the rocks below me into a slippery mess, and more than once I suddenly found myself in a heap on the boulders with camera, flashgun, and tripod jumbled on top of me.

The spray also gathered in crystal beads on a stubby, bouncing bird, the object of my camera hunt. Clad in a waterproof suit of silvery gray, this dipper, or water ouzel, reveled in the tossing mists.

Be it tumbling rapids or booming waterfalls, it's still home to this bird of the mountainous West. Al-

◂ **The dipper**, or water ouzel, clowns its way through an exciting life along turbulent mountain streams. It builds its nest on cliffs above rushing water or even behind waterfalls — almost completely inaccessible to enemies



though a relative of the wrens and thrushes, it has broken tradition to take up the diving and swimming life of ducks and grebes.

The dipper skims over the mountain streams through myriads of miniature rainbows that tumble in the mist. Alighting on a glistening rock among the rapids, it pauses for a moment, teetering up and down in typical dipper fashion, as if it can hardly wait for the next plunge. And plunge it is, for the ouzel jumps off its granite springboard in as smooth a swan dive as any merman could ever hope for. Then there is that restless pause; somewhere under the frothing stream the dipper is calmly walking and plucking water insects from the rocks—plucking food while gallons of water rush past by the second.

Half a minute later and some fifteen feet up the stream, the dipper emerges—a specter from the deep. Grinding up the shore like an amphibious tank, he staidly runs to the top of the rock with a bill full of squirming insects.

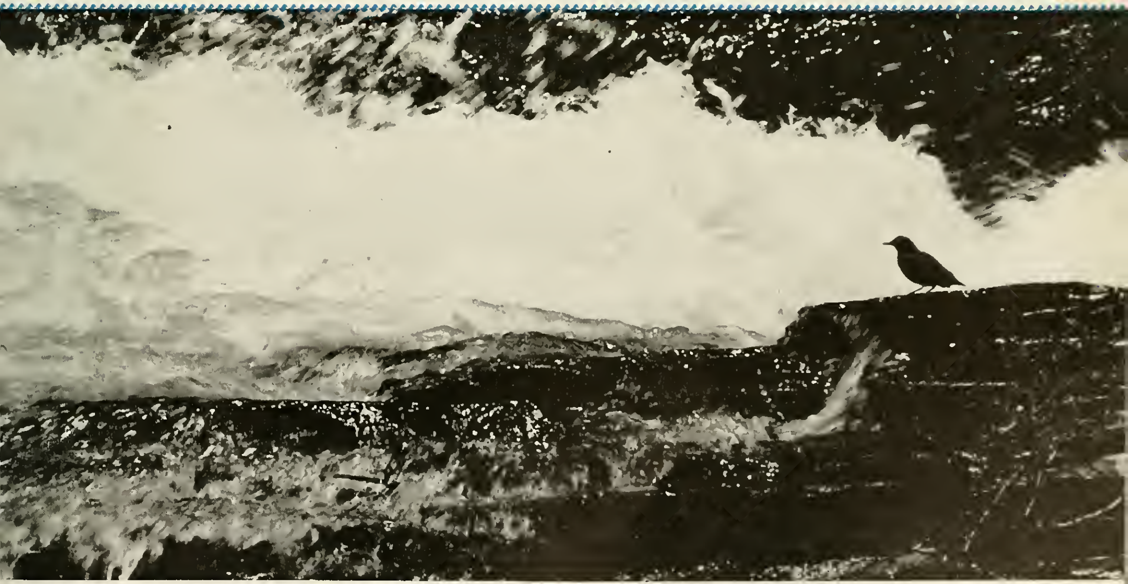
Sometimes his approach is much more subtle. He simply walks down a slanting rock into the water. As he steps on down, a ripple of water curls over his head, meeting and breaking like a miniature tidal wave. And then he's gone. The terrifying part about all this is the places he picks for the stunt. Frequently it is in the fastest section of the stream. Once it was on the brink of a fifteen-foot waterfall, where the current should certainly have swept him over. But he still came out of the water in almost the same place where he had coyly walked in.

The frothy lacework of the mountain streams is broken here and there by quiet crystal pools. Through such clear water we could easily watch the ouzel as it leisurely waded to the bottom and deliberately walked about while probing for prey under the edges of rocks. Here the wings were used more for balance than for actually flying under water. Once grasping the food, the bird floated up like a cork and then took off from the surface as if pushed by hidden springs.

At times the dipper would plunge into the water while flying and continue its flight two or three feet under the surface. The wings had to be used in this underwater swimming, for the ouzel could never progress rapidly enough with its feet alone, which are not even webbed. Some observers believe that it can not only enter the water flying but also come out of it flying.

All the time that I was waiting for the dipper to come before the

The fleeting, fearless dipper, without benefit of webbed feet, can fly two to three feet beneath the frothing waters of a mountain stream in its restless search for food



HUNTING GROUNDS—the foaming torrent. The rocks are
y, and even the agile dipper sometimes slides on its ab-
ed tail. But it quickly recovers its active composure

▲ THE DIPPER DIVES directly into the swift stream and then calmly walks along the bottom with the help of its wings. Under the water, it feeds on aquatic insects camera, I was getting wetter and wetter. Any moment I expected webs to sprout between my fingers. Finally, the bird buzzed back up the stream and rewarded me with an incident I shall always remember; at last, after days of careless bouncing on slippery rocks, he was fooled. He erred when he flew full speed toward a very wet rock that was coated with a thin film of algae. I held my breath—surely not even the dipper could keep his balance there! And he didn't. His feet slid out from under him as soon as he hit, and he made a three-point landing on his poor excuse for a tail. He bounced back to quick recovery, though, and was off for more feeding, this time on a small, nearly vertical waterfall.

The cascade was an offshoot from the main falls and usually had just a trickle of water running over it. At times, however, a sudden gust of wind would shift buckets of water over this small fall, much to the surprise of the dipper. The quick deluge completely covered him and threatened to push him off the glazed rocks, but he jumped out in a flash and fluttered to the closest boulder.

The dipper obtains most of its food in, on, or under the water of its favorite mountain streams. It is very fond of caddis fly larvae, for which it probes under the small stones on the bottom. There it also finds other larvae, aquatic worms, and various other forms of animal life.

Some of these tidbits are washed down over the waterfalls to transform the quiet pools under the falls into a favorite cafeteria for the ouzel. To pick up the floating insects, it either whirls among the foam bells like a duck, using its feet as makeshift oars, or flaps along the surface with the help of its wings.

Under sunken logs or rock slabs it dives for trout fry and other small fish. Fish as much as two or three inches in length are often captured, taken ashore, and killed by vigorous beating. With fish, the ouzel occasionally damages its reputation, for the eggs and fry of salmon and trout are sometimes so abundant that the ouzel is tempted to feed on them too freely to suit the fisherman. Usually, however, the loss is slight, because both kinds of fish produce large surpluses of eggs.

Just as much as the rounded pebbles and the rainbow mist, the dipper is the fruit of the sparkling rapids. And it continually shows allegiance to its wellspring, for seldom if ever does it wander overland away from the waterways. Rather than cross the neck of land between two tributaries, it mechanically flies down one stream, turns an acute angle at the mouth of the second stream, and then goes whirring merrily up it. In following an irrigation ditch, the dipper promptly turns at a right angle with the canal.

Constantly caught in the spray from the stream, the ouzel is forced to brush aside the watery vapors by winking. Since the eyelid is covered with small white feathers, the winking is visible for some distance. The less noticeable nictitating membrane may also do the winking, and some people have even maintained that dippers protect their eyes under water with this membrane. This is highly unlikely, since the membrane is translucent and not transparent. Under water the dipper keeps its eyes open just as any man swimming below the surface. A movable scale covers each nostril to keep out water when necessary.

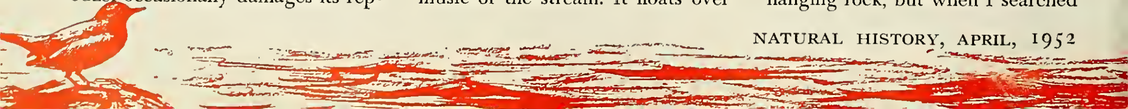
Only when the dipper is resting, sleeping, or incubating does it appear at ease. Any other time, it is constantly dipping or bobbing up and down as though it were mounted on coil springs. This habitual bouncing, about once every second, is the reason why the bird is called the dipper.

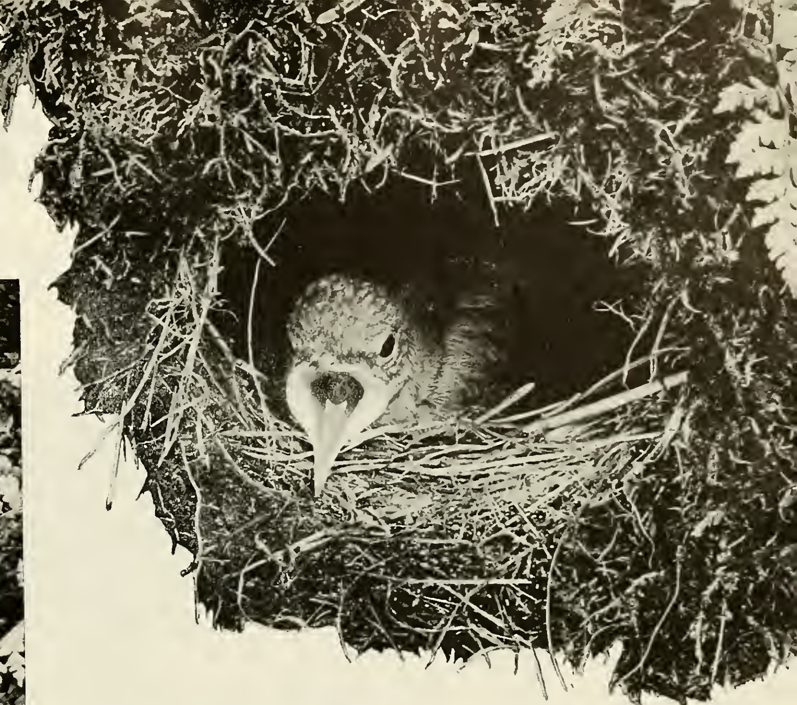
▼ STILL WET with spray from the wate
falls, the dipper arrives with food f
her young. The nest is the inconspicuo
mass of moss just above her. The mi
keeps it moist and green on the outsid
but it remains relatively dry inside

The dipper momentarily stops its teetering to burst forth in a mellow, bell-like song. In all seasons and in all kinds of weather the dipper sings in chorus with the streams. Indeed, the song is much like the music of the stream. It floats over the rapids like a group of fluty foam bubbles, bouncing and bursting, now melting into the din of the torrents, now reinforcing and rising above it.

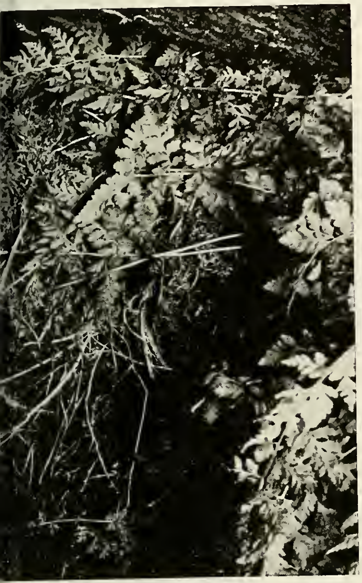
As the alpine snow fields disappear in late summer, the song of the ouzel also reaches its lowest ebb. But as autumn snows and thaws begin to replenish the mountain streams, the dipper's song also begins its winter build-up. With the springtime melting, the water booms down the mountainsides in rushing torrents, and then, too, the dipper reaches the flood tide of its joyous music.

With the spring thaws must also come the building of a nest and the raising of a family. The nest I was photographing puzzled me for some time. I had seen the female dipper make several trips under an overhanging rock, but when I searched





THE YOUNG DIPPER sees its parent oming. Its three nest mates had left or the day, but they returned toward usk. Only when as big as their parents o the young leave the nest to brave ife along the turbulent streams



the area there seemed to be nothing more than a few clumps of moss. Then I looked more closely. One of those inconspicuous clumps of moss proved to have a concealed opening. Inside the domelike shell there was a bowl-shaped lining that held four young. The outer sphere about ten inches in diameter, was composed chiefly of moss. Continually dampened by the rainbow spray, the outer greens thrived as though they had never been picked. Within the moss igloo the coarse grass of the inner bowl resisted moisture and was relatively dry.

The dipper hut is always placed near the beloved mountain torrent in as inaccessible a spot as possible. Sometimes it is in a crevice in a precipitous wall—a castle protected by a moat of rushing water. Sometimes it is hidden under a waterfall by the drenching downflow. It may be plastered to the side of a rock in the middle of a swirling cascade. One dipper even nested among the roots of an upturned stump that was floating in a millpond.

An ouzel in Yosemite was a little too fanatic in its love for the bouncing waters. The female placed her nest so close to the river that spring floods eventually covered it on two successive evenings. Undaunted by the soaking, she still succeeded in brooding the eggs and raising four young. Presumably, there was an air pocket in the nest during the nightly dunking.

Since the opening to the nest is quite small, only two or three young can squeeze out at one time. When the parents come with food they make no attempt to feed all nestlings. Instead, the food goes only to the nearest one. This could be disastrous were it not for the fact that the hungrier young eventually manage to squirm into first place in the chow line.

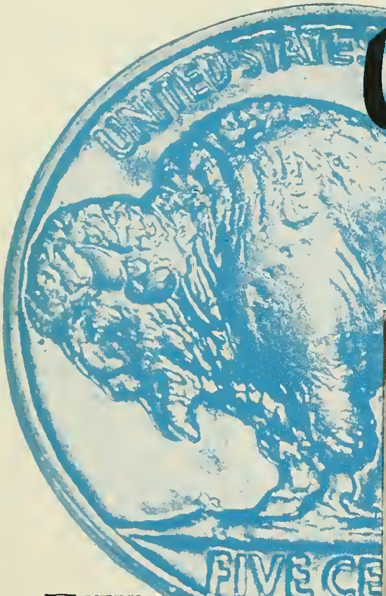
When the young dippers leave the nest they are almost as large as their parents. As if afraid to face a world of surging water, they first creep out of the nest, cling to the rock wall, and then return again to their moss hut before leaving for good. When they finally flutter down from the nest, it is only after first choosing a very safe landing spot.

Once along the stream, they spend most of their time ashore on rocks or along the rough banks. I thought surely they would slip into the raging torrent, but such mistakes rarely happen. Both young and adults are quite able to cling to very slippery surfaces. Should they slip, they quickly regain their footing with a few wing flaps or with swimming.

Accidents do happen, though, and I had the misfortune of causing one. As I peeked into a newly found dipper nest, I was greeted with an explosion of excited young birds. One fledgling came out so fast that he inadvertently landed in the stream just above the waterfalls. Before he could swim or flap to safety, he was quickly whisked over the brink of the falls to what I thought would surely be his doom. Ahead of him thundered 50 feet of raging rapids and cataracts,

Continued on page 192

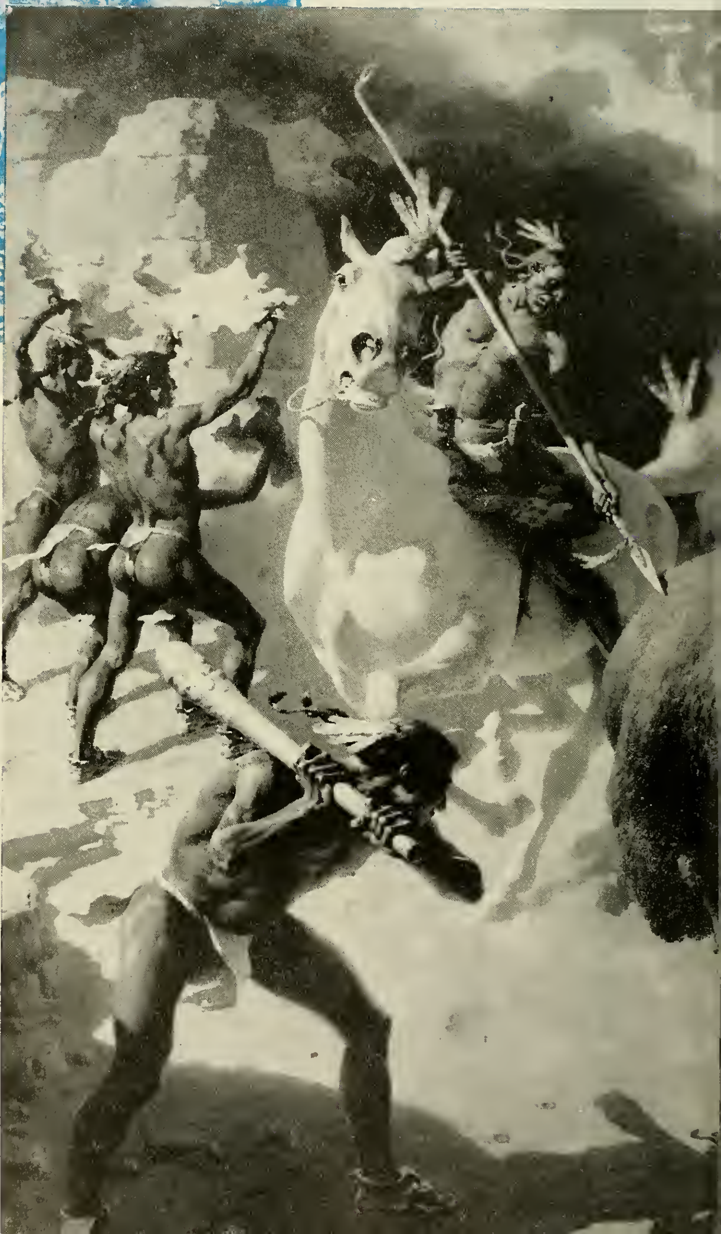
Coronado's Crooked



EVERY American carries around with him a reminder of the thundering herds that once thronged the plains of the Middle West.

In this modern age of progress, science has left no time for reflection or thought. Yet in the pocket of every one of us is the buffalo nickel—a symbol that is daily passed over the counter of every store in the United States.

Just as time swept the plains clear of our wildlife, so the stately old buffalo bull on the nickel is fast passing into oblivion. For years it would buy a good cigar, a cup of coffee, or a ticket to the nickelodeon. New York's milling crowds rode to work from the Bronx and Queens by subway, bus, and trolley on a nickel. The tinkle of a nickel in the telephone daily brought millions of people together. If the nickel had suddenly vanished a couple of years ago, most of the business in Metropolitan New York would have come to an abrupt stop.



➤ BUFFALO DRIVE: a dynamic painting by the celebrated artist William R. Leigh, depicting a typical scene in the hunting life of the Indians. The original measures 6½ feet by 10½ feet

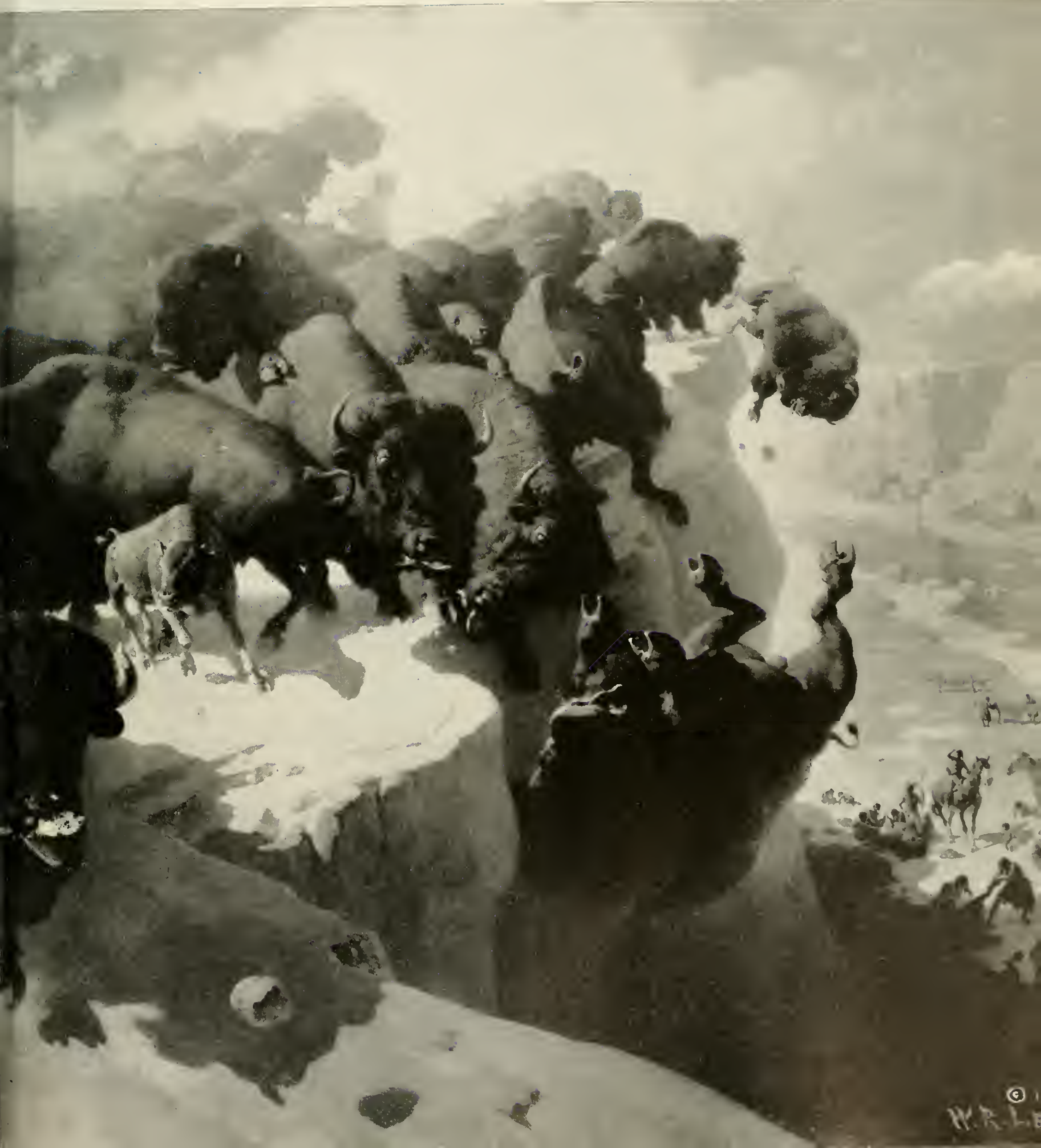
They stormed their way through our early history and influenced the life of a frontier nation. But today most Americans know this animal chiefly as a symbol on a coin, which itself is becoming emblematic of a bygone day

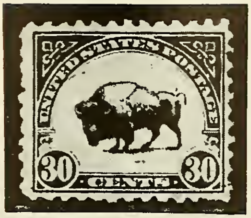
Backed Oxen

By George G. Goodwin

Associate Curator, Department of Mammals, American Museum of Natural History

Painting photographed by Peter A. Juley and Son





▲ Possibly from the same drawing Charles R. Knight made for the 10-dollar bill

The nickel is now no longer the most popular coin in the realm, one cherished by every straphanger. It is now accepted almost reluctantly as legal change.

The buffalo nickel, first minted in 1913, did not commemorate any special occasion, but it did immortalize the bison. The artist, James E. Fraser, in creating the design, used as a model the great bull bison named Black Diamond that was then in Central Park Zoo, New York City. This famous animal was born in 1893 from a bull and a cow presented to the Zoo by the Barnum and Bailey management, and the keeper at the Zoo was Bill Snyder.

At the grand old age of 22, Black Diamond, now disabled and rheumatic, was put up for sale. He was auctioned on June 28, 1915, but received no bids. A dealer in meat and game, A. Sills Inc., bought him for $300 in a private sale. Isaac Seligman, a banker, and others tried to save the great creature from such an ignoble ending and offered up to $1000 to buy him back, but it was to no avail. Black Diamond was slaughtered in November, 1915, and registered a net weight of 1020 pounds. The head was turned over to Fred Santer, a New York taxidermist, to mount, and the skin was made into a robe. Whatever became of these relics, no one seems to know.

The ten-dollar bill issued in 1901, at the time of the Buffalo Exposition, was engraved with a complete reproduction of a bison on the center of the face of the bill. The issuance of this bill, however, was in no way connected with the exposition. The artist who made the drawing for the engraver was the famous animal painter Charles R. Knight, whose murals adorn the Osborn Hall of the Age of Man at the American Museum of Natural History. The bison used as a model was a 2000-pound bull named "Pablo" in the National Zoological Park, Washington, D. C. This particular bison came from the Pablo-Allard herd and was purchased from Michael Pablo of Ronan, Montana. It was born in 1895 and was received at the National Zoological Park on October 23, 1897. It died on October 3, 1914, at the age of nineteen and was buried in the park grounds.

Mr. Knight, the artist, tells an interesting story of how he happened to get the job. It seems that one day when at the National Museum in Washington, he happened to see a man making a sketch of a bull bison in a group mounted by William T. Hornaday. Being of an inquisitive nature, Mr. Knight learned that the man, a Mr. Baldwin, was an engraver and that the sketch of the bison was to be used on a ten-dollar bill. Mr. Knight offered his services, and much to his surprise, they were promptly accepted. However, Mr. Knight chose to use a living model in the National Zoological Park instead of the stuffed specimen at the museum. (This incident probably gave rise to the erroneous report that the buffalo on the nickel was taken from a large bull killed by William T. Hornaday in Montana and mounted for the National Museum.)

This same design, executed by Mr. Knight, is also said to have been used on the thirty-cent U. S. stamp issued March 20, 1923, though the U. S. Post Office Department claimed in 1949 that the design was taken from a photograph.

A four-cent U. S. postage stamp picturing an Indian hunting buffalo was issued to commemorate the 1898 Trans-Mississippi Exposition. This design is from an engraving in *Schoolcrafts History of Indian Tribes.*

The first known drawing of the American bison was a crude but nevertheless recognizable representation printed in Gomara's *Historia de los Indios Saragossa 1552-1553.*

Since the Spaniards were famous for their cattle (they introduced the traditional Longhorn steer into America), it was indeed fitting that a Spaniard should be the first white man to discover the bison in America. When the Spanish explorer Cortes stood in the courtyard of Montezuma's house, having fought his way to the Aztec capital, now Mexico City, he saw the first American bison to be viewed through European eyes. Little did he realize that this strange creature with its humped back and shaggy coat, which he described as a "rare composite of several divers animals," would play an important part in American history. Cortes is generally said to have reached Mexico City in 1519, but Ernest Thompson Seton gives 1521 as the date when he saw the bison.

This animal in Montezuma's private zoo was at least 300 miles from its native range, and not until 9 years later did Alvar Nunez Cabeza de Vaca actually discover the bison, in what is now southeastern Texas. So far as history tells us, this was the first meeting of the wild bison and the white man.

Coronado was the next to penetrate bison country, and he was perhaps the first to see the animal in its pristine abundance. Entering by way of Arizona and New Mexico, he reached bison country in 1542 and crossed the plains of Oklahoma, which he aptly described as "full of crooked-backed oxen."

Early explorers who actually saw the bison herds did not leave any exact estimate of their numbers, only such records as "teeming myriads," "countless herds," and "incredible numbers."

In Arkansas in May, 1871, Colonel R. I. Dodge saw a herd moving north, which he described as 25 miles wide and stretching north and south as far as the eye could see. It took a whole day for the herd to pass.

At that time, bison covered about a third of North America, but it should not be supposed that the plains and prairies anywhere were black with bison all the time. The great herds were constantly on the move, and no area was overgrazed. Occasionally among the teeming herds there was a white bison, which was considered by the Indians as the special property of the Sun God.* When a white buffalo was killed, none of the meat was eaten. The tongue was cured and presented to the Sun God with prayers and supplications at the annual ceremonial gatherings. On rare occasions, a bison was killed that had soft hair or a "silk" coat. The Indians believed that this special coat occurred when a motherless calf was subjected to constant licking by the herd. Even if such a treatment might affect the coat of the calf, it could hardly be carried forward through successive annual molts. The "silk" coat can only be attributed to some abnormal peculiarity of the individual.

Unlike most animals, a bison always faces a storm. This is understandable, because the animal is well clothed in front and has only a scanty covering on the rear.

The bison is normally timid and of a mild, inoffensive disposition, but a herd will stampede with little provocation. The Indians took advantage of this and made a practice of stampeding herds of bison over a cliff. One of the most famous natural deathtraps for the bison was Buffalo Jump-off in the valley of the Yellowstone River, Montana. In its day, this cliff was comparable to our slaughter yards in Chicago. The Indians did not seek to destroy the bison wantonly but only to secure a periodic harvest of food, and the supply could not be permanently affected under the methods they used. The meat of the slaughtered animals was cut into thin strips, smoked, and dried. This was known as "jerked meat," or "jerkey," and was hard as rocks. Later, the dried meat was pounded into a fine powder and mixed with berries and fat. In this form it was known as pemmican.

The historic highways of America were first laid out by the bison. Through the centuries the moving herds followed the best routes across the continent and over mountain passes. Great steel and concrete highways now follow the trails once trod by the bison. The Baltimore and Ohio Railroad between Grafton and Parkersburg in West Virginia not only follows a bison trail throughout its course but in two instances, where it is compelled to tunnel, the bison trail runs exactly over the rail tunnel.

As an abundant animal, we can only say wistfully that the bison served well its time and purpose. It was the main source of sustenance to many tribes of Indians, and it supplied the early pioneers and settlers of the West with food and clothing. Many Americans of today have only the haziest idea of this animal. Except for the buffalo nickel and a few specimens in parks, zoos, and museums, it has all but disappeared into the mists of history.

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* See "The Sacred White Buffalo," by Harold McCracken, NATURAL HISTORY, Sept., 1946.

UNITED STATES OF AMERICA
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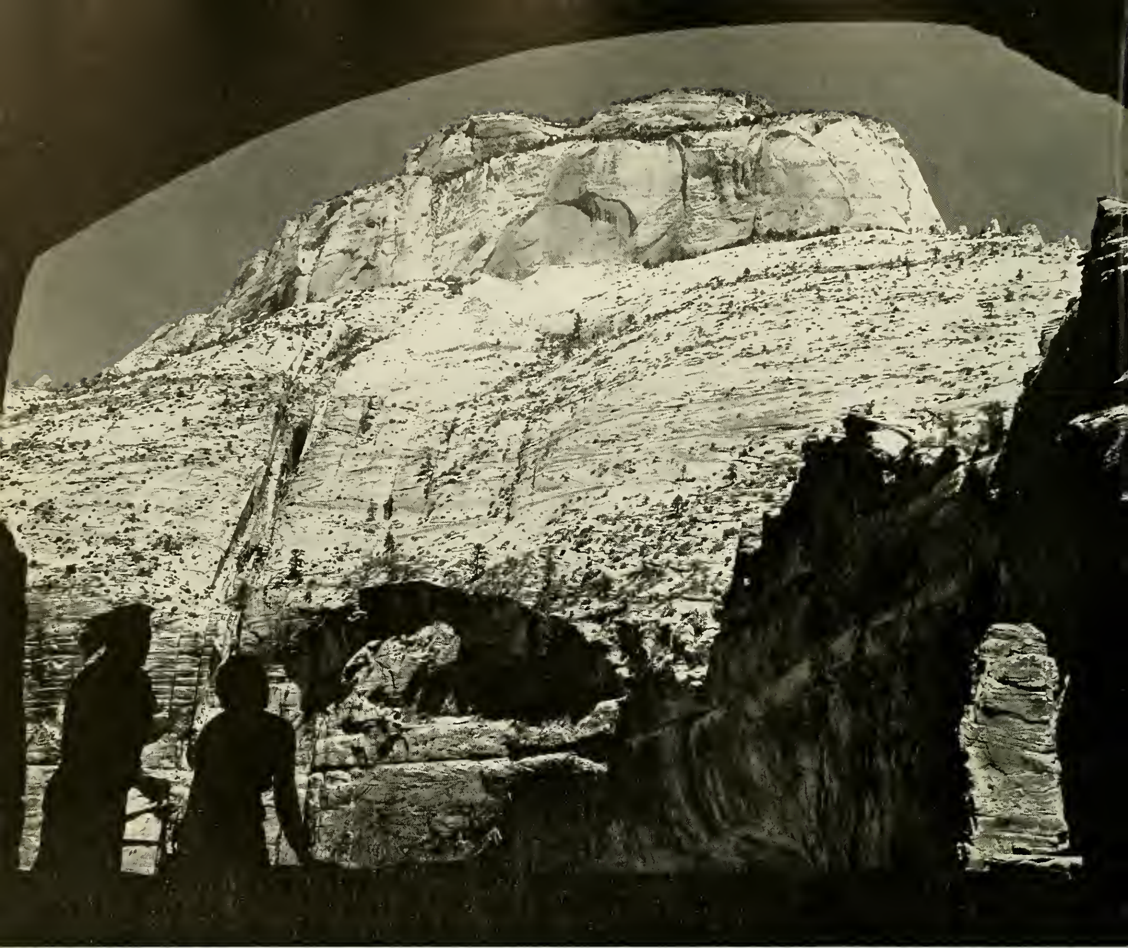
AMNH photos

ONLY A FEW bison remain on preserves. Once their myriad hoofs plotted the best routes of travel across the continent and over our mountain passes



▲ EAST TEMPLE viewed through a tunnel on the Mt. Carmel Highway. Trees and shrubs struggle desperately to cling to the steep walls of this formation far above the floor of Zion Valley

Zion National Park

To the Indians, its towering cliffs were the home of gods;
to the geologist, it tells the story of an ancient river

By
HAROLD E. VOKES
Johns Hopkins University

Photographs by
JOSEF MUENCH

"IT is *not* 'Zion'!" exclaimed a horrified Brigham Young, in whose religious thinking the term was reserved for a region that certainly would not be defined in terms of worldly geography. And so, "Not Zion" it became, at least in the conversations of the faithful who dwelt in that part of southwestern Utah.

In their hearts, however, it remained "Little Zion," the place of refuge: the sanctuary from marauding Indians, who would never permit themselves to be in the valley at nightfall. To the Indians this was the home of the gods and demigods. The towering pillars and cliffs were their seats and resting places, and one especially awesome precipice of white sandstone, whose summit is stained a brilliant red, was certainly the place of sacrifice. Visit the canyon on a bright moonlit night, give your imagination full reign, forgetting the taboos of civilization, and you will find that you can readily sympathize with them in their beliefs!

The canyon has had almost as many names as it has facets of scenic beauty. It was originally homesteaded in the 1860's by Joseph Black, a Mormon pioneer, whose descriptions were so poetic that his friends dubbed it "Joseph's Glory." Later it was "Little Zion," then, on Brigham Young's objection, "Not Zion." The Indians, referring to the steep walls and almost inaccessible upper limits, called it *I-oo-goon*, meaning "Like an arrow quiver." The first scientific explorer of the canyon, John Wesley Powell, one-armed conqueror of the Grand Canyon of the Colorado, named it Mukuntuweap Valley in an official Government report made after a visit in 1872. It was under this name that the canyon was set aside as a National Monument by President Taft in 1909. When later additions were made to the area of the Monument and it was given the status of a National Park, the name was changed and it became "Zion Na-

▼ GREAT WHITE THRONE, viewed from beneath the arch of Weeping Rock. Note the trees growing on inaccessible ledges on the face of this mammoth rock

tional Park." At that time also, the canyon officially became "Zion Canyon."

On January 22, 1937, by Presidential Proclamation, an area to the west of the National Park was set aside as Zion National Monument. Thus, today we have a Zion Canyon, set in a Zion National Park bounded on the west by a Zion National Monument! Mercifully, Brigham Young did not live to see the day!

If its naming appears to have been complicated, the geologic story of the formation of Zion Canyon can surely be called quite simple. Twenty to thirty million years ago, a vast area in southern Utah and northern Arizona began to rise. The strata present were not much folded or distorted. The Hurricane fault, a great rift area that margined the uplift zone on the west, shows that the land to the east, including the present Zion Canyon area, rose at least 5000 feet with respect to the deposits of the same age to the west of the rift. The rise was slow, so slow that the ancestor of the Virgin River flowing in the Zion region stripped away vast quantities of rock. The river appears to have worn away the land almost as quickly as it rose beneath it, so that the water flowed with but little gradient across the whole area.

Much later, possibly within the past five million years, further and more rapid uplift occurred. The rivers could not keep pace with the rate and so, instead of leveling off the country as it rose, they cut steep canyons. At the time this uplift began, the ancestral Virgin River was flowing across the top of a great deposit of sandstone. The canyon that it subsequently cut was intrenched into and, in its lower reaches, through this formation.

This great sandstone, which in the Zion Park area forms almost a single bed more than 1500 feet thick, is known to geologists as the Navajo Sandstone, because of its exposures in the Navajo country of northeastern Arizona. The formation crops out widely from southwestern Colorado and northeastern Arizona on the east, to the Uinta Mountain region on the north and to southern Nevada. There, in a red-colored phase that is more than 2000 feet in thickness, it has been known as the Aztec Sandstone. Traced to the northeast from the thickest areas in Nevada, the formation tends to become thinner and to be white or light gray in color over much of Utah and Arizona. The change from red to white occurs mainly in the vicinity of the Zion Park area. This accounts for the fact that what appears to be a single great bed of sandstone in the walls of the Zion Canyon tends

EAT WHITE THRONE in autumn. Fremont Cottonwoods in autumn dress
e the most famous formation in Zion National Park. Its great bulk,
ping into the sky, changes color with the daytime hours, but it is always
tiful and awesome under any sun or season

WONDERFUL ROAD, emerging from an almost mile-long tunnel, switchbacks
the slopes to enter Zion Canyon amid towering cliffs of brilliant rock

▲ THE THREE PATRIARCHS seen from the back: a view from the East Rim Trail

< **Zion Canyon** as viewed from Observation Point, a lookout on the East Rim, showing the Virgin River snaking its way through the Valley, with the Park road beside it

to be red at the base and white, with occasional lenses of red color, in its upper part. Thus the "Great White Throne" has a red base and a white top, while the "Altar of Sacrifice" has an apparently blood-encrusted upper surface formed of a lens of red sandstone, whose weathered debris simulates blood flowing down its sides.

The Navajo Sandstone is a remarkably uniform deposit of pure quartz sand, usually intricately and prominently cross-laminated in a manner that clearly suggests that the entire formation must have been formed of tremendous sand dunes blown across an arid, desert-like region. The dune sands were, subsequent to their deposition, cemented either by lime or by iron oxides. Where the cementing material is lime, the resultant rock is white; where it is iron, the rock is red.

The uniformity of the Navajo Sandstone, without zones or beds of weaker resistance to the forces of weathering, results in its tendency to develop erosional features that are highly distinctive and picturesque in their over-all effects. Its upper surfaces become broad, rounded domes. Its canyon walls rise sheer from their bases and often are decorated by natural bridges, arches, and cliff caves. Rainbow Natural Bridge and the bridges at the Natural Bridges National Monument are carved from this formation.

Without the ancient desert sands that now form the Navajo Sandstone, Zion Canyon would not exist in its present form, and the Southwest would lack much of its picturesque beauty. America owes much to desert winds that blew almost 150 million years ago!

^ **Two horseback riders** give scale to the massive walls that rise to the East Rim of Zion Canyon

> **Sentinel Peak**, towering in rugged grandeur above the silvery water of the Virgin River

The Tyrant's TINY COUSIN

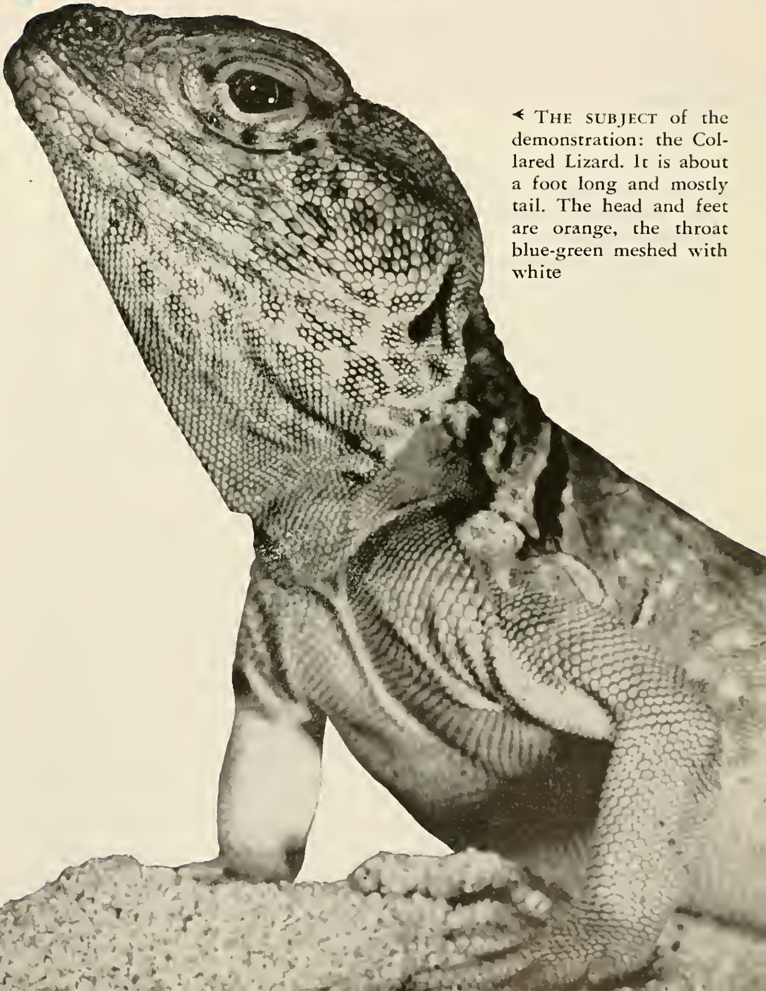
This unusual photographic study catches the Collared Lizard running erect on his hind legs—a habit he shares in common with the gigantic dinosaurs of old

By Walker Van Riper
Denver Museum of Natural History

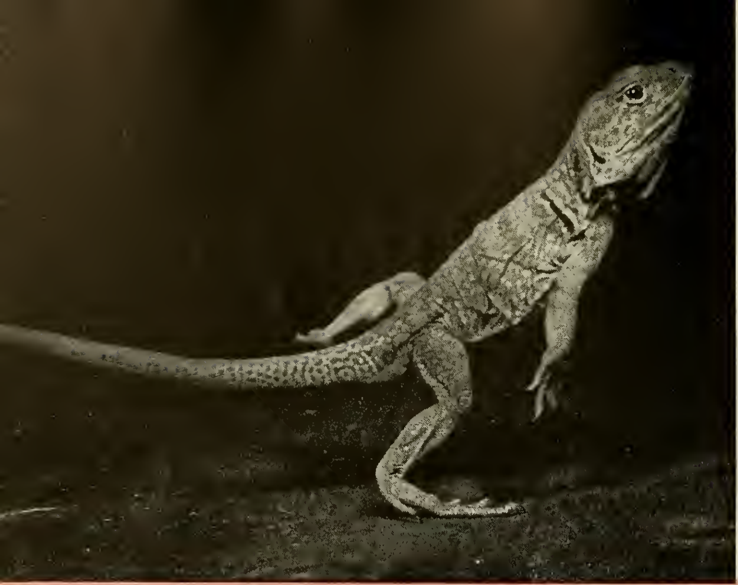
All photographs by the author

AMONG the greatest of the prehistoric reptiles was the carnivorous dinosaur, *Tyrannosaurus rex*, whose name means King of the Tyrant Lizards. He was 45 feet or more in length, with big head, powerful jaws, and a long tail; and he had the habit of running erect on his hind legs. In the 60 million years or more that have elapsed since this monster ruled the roost, all his tribe have been minified to the point of relative Liliputianism. But they have persisted and are present now on the earth, possibly in greater number and variety than in the Mesozoic Era, the Age of Reptiles. At any rate, some 3000 species of lizards are now known, and they are found all over the world except in the coldest parts.

One of the handsomest and most interesting of these is the minuscule "Tyrannosaurus" portrayed in the accompanying pictures—the Western Collared Lizard, *Crotaphytus collaris baileyi*. The specimen photographed was found on a rocky mesa in western Colorado. This lizard is about a foot in length, the head and body accounting for about a third of this, the long, slender tail the remainder. Like Tyrannosaurus of old, the Collared Lizard runs in high gear on his



◀ THE SUBJECT of the demonstration: the Collared Lizard. It is about a foot long and mostly tail. The head and feet are orange, the throat blue-green meshed with white



▲ THE HIGH-SPEED FLASH caught the lizard high-stepping it for his box

▲ HE RAN FAST, but the 1/5000 secon

hind legs in an astonishing manner.

The chief purpose of this series of photographs was to study the collared lizard's two-legged locomotion by means of the high-speed flash. This proved no easy task. The scheme that worked best was to place the lizard's box at one end of a long table and the creature at the other. The side of the box was folded down, and some light shone on this area, the rest of the room being fairly dark. The table was covered with Celotex to give the lizard good footing.

The animal was started with the tap of a finger or a little electric shock. He would move a couple of feet on all fours, then rise on his hind legs and dash for the box. Sometimes things went as planned, sometimes not. When all the luck was on my side, I snapped him as he went by the camera, using the high-speed electronic flash invented by Dr. Harold E. Edgerton of M.I.T. The exposures in this case were 1/5000 second at f.32.

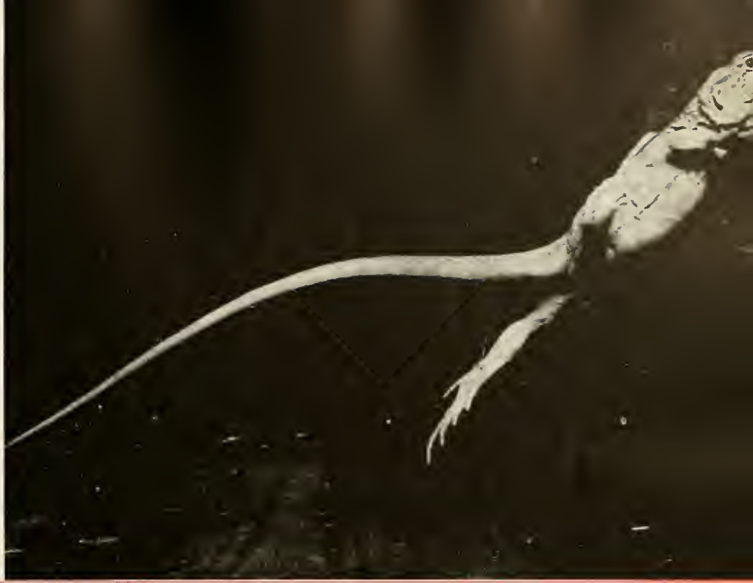
We learn from C. M. Bogert, of the American Museum's Department of Reptiles and Amphibians, that the collared lizard is more readily observed than other lizards in the United States that run on their hind legs. This is partly because its movements are not nearly so rapid but also because the collared lizard can raise the body to the bipedal posture virtually from the resting position. Other lizards, notably the leopard lizard *(Crotaphytus wislizenii)* and the desert iguana *(Dipsosaurus dorsalis)* usually attain some momentum before the forelimbs are raised from the ground.

"Bipedal locomotion," says Mr. Bogert, "is not at all rare in lizards, as a matter of fact. But unless the lizard raises the front of the body well off the ground, it readily escapes notice. It is uncertain whether some of the lizards in the open, arid regions of the Southwest use all four limbs when running at top speed. Many of us suspect that some whip-tailed lizards, *Cnemidophorus,* as well as the fringefoot, *Uma,* and the zebra-tailed lizard, *Callisaurus,* are bipedal under some conditions. However, until somebody with an outfit like Van Riper's supplies the evidence, we cannot be sure. In Honduras, when I got close enough to a large black iguana, or 'garobo,' *Ctenosaura similis,* it seemed pretty evident that the front feet were not used even though the front of the body was scarcely elevated above the horizontal.

"It has long been known, of course, that the various species of the basilisk *(Basiliscus)* in the American tropics are all bipedal, whether on land or in the water. They are the 'paso rios,' or 'river crossers,' in many parts of Latin America and sometimes the 'Jesus Cristo' lizards because of their ability to run on the surface of the water. They sink into it, however, if they lose momentum and swim ashore if they have to. Dr. A. A. Allen of Cornell obtained high-speed flash photographs of the basilisk that were published in *Copeia* in 1949. His pictures show clearly that the posture as well as the movement is much like that of the collared lizard.

"Probably the most famed of the bipedal lizards is the frilled lizard

posure stopped him in his bipedal tracks



▲ **OVER THE WALL** and into his box the lizard sailed—doing very well without his forelegs

of Australia and New Guinea. This is a moderately large lizard that habitually runs on its hind legs when on the ground, although it is equally at home in trees, which it climbs with agility, using all four limbs. The arboreal casque-headed lizards *(Corythophanes)* of the American tropics are also bipedal, as we discovered a couple of years ago when we obtained a live specimen from the Mexican state of Chiapas. It is not at all clear why such lizards utilize this method of locomotion when on the ground—where they are rarely seen.

"Contrary to some statements," continues Mr. Bogert, "the habit of running on the hind legs is not restricted to lizards inhabiting plains or open terrain. The collared lizard is a rock-dweller, being restricted to piles of boulders or rocky situations, even in regions that are essentially flat. Its relative, the leopard lizard, is more often encountered in shrubs, sometimes in dunes, and less commonly in boulders. Thus we find bipedal lizards along rivers in open terrain, or in rocks. Regardless of other conclusions that might be drawn, it seems obvious that there is no close correlation of the habit and the habitat.

"It may be added that bipedal locomotion must have arisen quite independently in at least two and possibly three families of lizards. The bipedal dinosaurs are, of course, quite distantly related. It is not impossible that alligators sometimes run on their hind legs. Indeed, they retain some of the musculature as well as hind limbs proportionately large in comparison with the forelimbs. Such features point to their descent from the early land-dwelling bipedal reptiles known as thecodonts, the same creatures that also gave rise to the dinosaurs. Some groups of dinosaurs retained the bipedal habits, whereas others returned to the use of all four feet to walk, crawl, or run. Possibly the bipedal dinosaurs were among the fastest of the lot. But the fast lizards are not necessarily the hind-leggers."

The lizard we show here has a really powerful bite and can raise a blood blister on the tip of a finger even though the tiny teeth do not break the skin. The animal is really pugnacious, and its jaws are strong. I learned the hard way to offer the creature mealworms and angleworms in tweezers rather than in my fingers. He consistently turned up his nose at a Black Widow Spider I offered him, which I thought would seem as delicate and juicy a morsel as a lizard could desire.

Especially the males of the collared lizard are brilliant and striking. The head and the feet are orange, the back is bluish-green dotted with white spots and crossed by six or eight narrow stripes of the same color as the head. The throat is blue-green meshed with white; and the tail is light and spotted with irregular blue dots on the upper part.

It is an interesting task to try to photograph lizards in motion, and since action photographs do not exist of some of the kinds, the photographer has the satisfaction of contributing worth-while information as well as carrying out an assignment that is not easy.

CALIFORNIA GULL

the BATTLE of the EGGS

Allan D. Cruickshank fro
National Audubon Societ

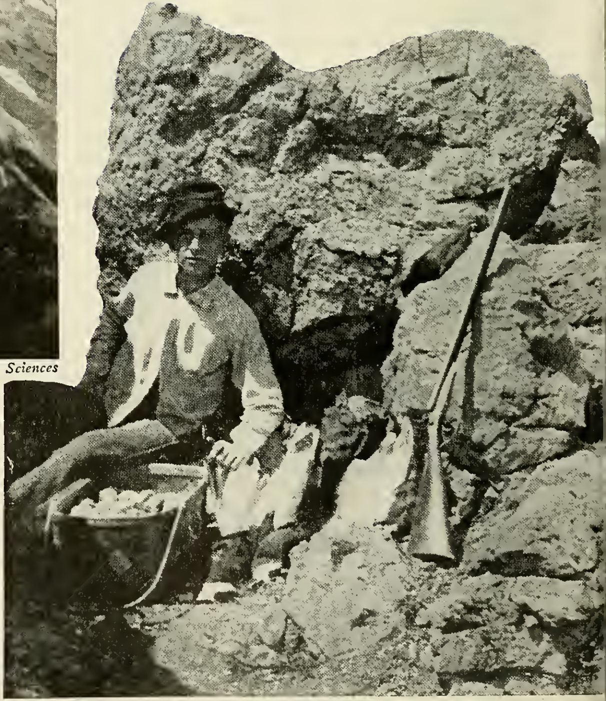
WESTERN GULL

A bloody war was waged through many decades for the annual harvest of eggs on the rocky Farallons not far from the Golden Gate

By PHILIP FERRY

Courtesy California Academy of Sciences

⮝ **CALIFORNIA MURRES**, whose hundreds of thousands of large eggs were the main booty of the commercial egg gatherers



➤ FROM the bloody past: an egg collector with his trusty gun close by. Food shortages during the Gold Rush sharpened the rivalry between competing groups of gatherers. Between 1850 and 1856, three or four million eggs were gathered by one company

STANDING 20 miles offshore from San Francisco is a clump of barren rocks known as the Farallon Islands. The rocks stand opposite the Golden Gate and are in plain view of the city on a clear day. Although the group is officially included within the city and county of San Francisco, few citizens visit the rocks. For one thing, it requires a well-inured sea-stomach to withstand the crossing of the Gulf of the Farallons to reach the islands. For another thing, the islands are devoted to the lighthouse service, and permission to land must be obtained from the Coast Guard.

For such a seemingly unimportant clump of rocks, sea-washed and uninhabitable as they are, they have had a long, interesting, and at times turbulent history. In fact, they have had a much longer history than the mainland, having been visited by some of the most renowned navigators in the early exploration of the Pacific, none of whom knew of the existence of the magnificent land-locked harbor so close by. The famed explorer-navigator, Juan Rodriguez Cabrillo, first visited the group in 1539. Kneeling on the shore of one of the tiny islets, he kissed the ground in traditional Spanish fashion and, naming the rocks Los Farallones, Spanish for "small, pointed islets in the sea," claimed them for Spain. Thirty-six years later Sir Francis Drake landed on one of the islands to take on fresh sea lion meat for his starving and scurvy-ridden crew.

Despite their forbidding appearance, the islands have yielded more natural wealth than any part of the city proper. Great herds of the Guadalupe Fur Seal formerly frequented the rocks.* Sea otters were also plentiful, while sea lions were and still are abundant. The New England sailing masters were the first to exploit the islands' natural resources. In the latter part of the eighteenth century, American sea lion hunters frequented the rocks for peltry. In the early nineteenth century, the Russians from their Alaskan outpost at Sitka occupied the islands for a generation and stripped them of their remaining fur wealth. Following the Russians' exodus, the Mexicans, who owned California until 1850, took sea lion and finished off the few otters in the area that had escaped the spears of the Russians. Then came the gold seekers. With the fur-bearing mammals extinct, one might wonder what these ambitious Yankees found to exploit. The answer is—plenty! They exploited the islands' one remaining resource — birds' eggs!

The islands are a natural rookery for sea fowl as well as marine animals. The endless flitting of sea birds is the islands' most familiar sight, their cries the most characteristic sound. To this day a visitor to the islands has a difficult time getting a night's sleep because of the teeming bird life.

The islands consist of three separate groups. The North Farallons comprise five sharp rocks rising abruptly from the sea, the tallest of which is 155 feet. The Middle Farallon is a single rock. The South Farallons are the largest and by far the most important group. The main island in this cluster of five, three-quarters of a mile long and half a mile wide, is surrounded with lesser islets like a planet Jupiter with its satellite moons. Its highest point is 340 feet above the waves. It is on this point that the lighthouse is poised.

It is an anomaly that these nude rocks, which will support hardly a blade of grass, should for a generation or more have contributed substantially to the mainland's food supply. The fortune seekers who came to California in the early fifties had little inclination for any pursuit save gold digging. Food was scarce, none being raised in California, and gold hunters were too busy poking around for "color" to stoop to anything so unglamorous as farming.

Providing food for a gold-mad populace became the city's most

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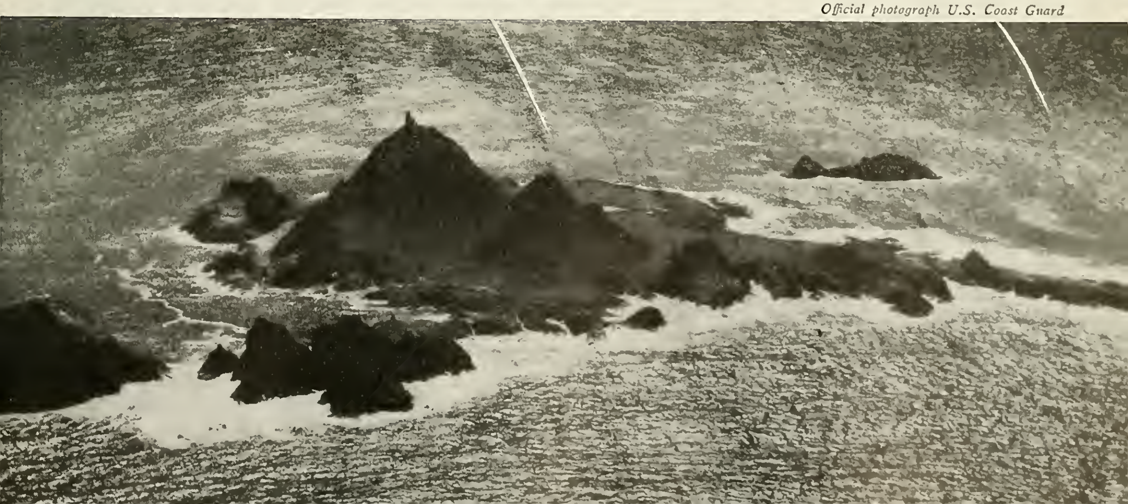
* See "Is the Guadalupe Fur Seal Returning?" by Andrew Hamilton, in NATURAL HISTORY for February, 1951.

▼ AIR VIEW of the South Farallons, the most important group. On the peak of the main island, 340 feet above the sea, stands the lighthouse

Official photograph U.S. Coast Guard



pressing problem. Gold dust was more plentiful than flour. San Francisco was separated from the rest of the country by the width of a continent. Every item of food consumed in the tumultuous city had to be imported. Vegetables came from Australia and the Sandwich Islands; lard from China; dairy products and bacon from Boston and New York; fruit from Chile; a few items from Mexico; and ice from Russian-America, meaning Alaska, at $75 a ton.

An unexpected source of food developed when it was discovered that the Farallon Islands were a great rookery for sea birds and that countless numbers of birds' eggs were deposited on the islands during the nesting season. Immediately, "seagoing poultrymen," as they were humorously labeled, began to exploit this crop.

So numerous were the birds that during the breeding season the sky would be darkened by their numbers and the air round about was filled with the cacophony of their cries. Before the coming of the Americans, the Russians had taken up to 50,000 birds annually on the islands. Their Aleut hunters preferred dried gull meat to the beef, venison, mutton, and bear meat of the mainland. The feathers and down from this catch were taken back to Russia.

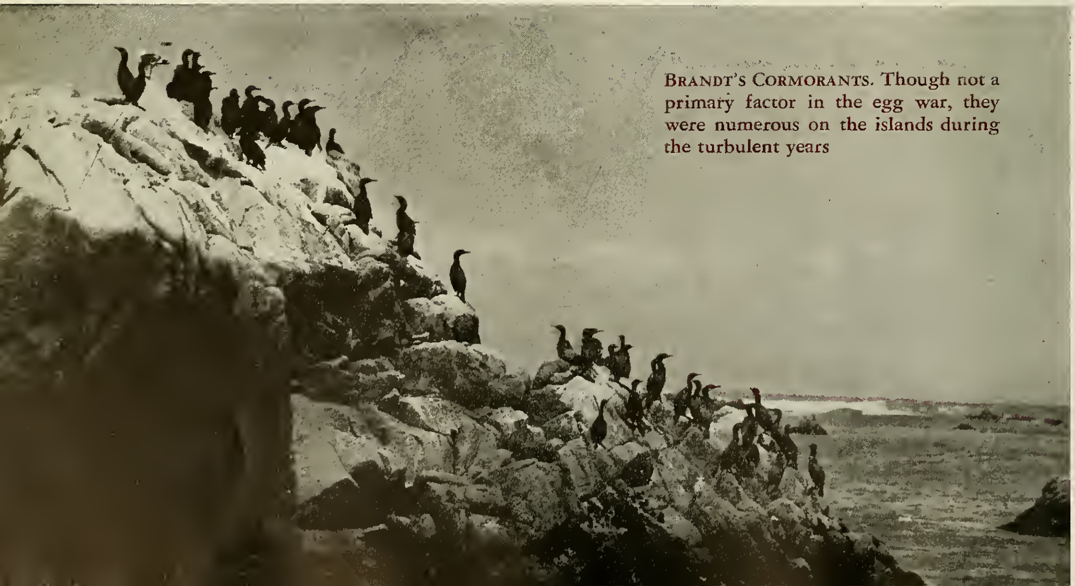
Several species of seafowl bred on the islands, as they do to this day, the most numerous being the Western and California gull, cormorants (Baird's, Brandt, and Farallon), Tufted Puffins, auklets, the pigeon guillemot, and the ashy petrel. Outnumbering all other species combined was the California murre *(Uria troille Californica)*. This bird surmounted every rocky peak and occupied every level spot on the islands—and many spots that were not level. It reached the islands in April and stayed until September.

The murre is found along the West Coast from southern California to the islands of the north Pacific Ocean, and north into Bering Sea and even to the Arctic Ocean. The Farallons, however, seem to have been the ancient stronghold of the race and attracted more nesting murres than any other area in the entire Pacific. On the Atlantic coast, the bird is found from New England to Labrador. It is a clumsy bird on land but at home on the water. It is strong on the wing, being swifter and more graceful in flight than either the puffin or the cormorant. It has a black head, slate colored body, and white breast. It is a noisy bird. In flight it frequently makes a peculiar grunting sound; on the rocks it keeps up a continual clatter, meanwhile bobbing its head up and down. It sits upright like a penguin and is generally found in colonies.

The murre lays an egg that is unaccountably large for the size of the bird. What is more, the egg is palatable and highly nutritious. This was the so-called "Farallon egg" that was gathered for the San Francisco markets and around which so much strife centered for nearly half a century. The egg has a remarkably thick shell and varies widely in coloring and markings. The color ranges from pure white to bluish-green and sometimes pink. The markings are as varied and striking as the coloring. The shell is so strong that the pickers simply tumbled the eggs into the boats for transporting to the mainland. While many of the shells might be cracked by this rough handling, they were seldom damaged sufficiently to impair their market value.

The murre lives on fish, shrimp and other crustacea, and mollusks—a diet responsible for a certain amount of prejudice. The egg was popularly reported to have a fishy flavor, and the more fastidious never knowingly ate it. However, San Francisco bakeries and restaurants used thousands of dozens during the summer months, and there were any number of wit-

Allan D. Cruickshank from National Audubon Society



BRANDT'S CORMORANTS. Though not a primary factor in the egg war, they were numerous on the islands during the turbulent years nesses to testify that when eaten fresh there was no objectionable flavor. On the contrary, contemporaneous gourmets testified that whether fried, boiled, poached, or prepared in any of the other popular styles of the day, they were "rich, delicate, and altogether desirable."

It is true that murre eggs acquired a rank taste sooner than hens' eggs. The egg gatherers were aware of this and made every effort to bring only strictly fresh eggs into the market.

Egg gathering began in late May or early June and continued for a couple of months, the pickers being paid by the dozen. While the gulls were soon finished with the laying, the murres continued to lay for six or eight weeks. Some idea of the bird population on the islands may be gained from the number of eggs brought into San Francisco markets in those early days. It has been estimated that in the half-dozen years between 1850 and 1856, one company alone, the Farallon Egg Company, gathered and sold between three and four million eggs. The late William Leon Dawson, noted California ornithologist, is authority for the statement that 500,000 eggs were sold in less than two months in 1854—all collected from the rookery at West End on the South Farallons.

Egg gathering on the islands began in 1850, when a single boat brought in a three-day harvest that totaled one thousand dozen and sold the entire cargo at one dollar a dozen. So alluring was this bonanza that a number of rival companies began to exploit the crop, with the result that every summer brought its "egg battle," a battle royal in which heads were cracked and blood was shed. This state of affairs continued for 40 years until the United States Government outlawed the taking of eggs from the islands, thus putting an end to the recurrent wrangling that made a seasonal battleground of the rocks.

Most of the eggs came from the Great Rookery at West End on the South Farallons, although the densely populated rookeries on North and Middle Farallons were also worked. The West End was the scene of the greatest excitement, since the promontory attracted the largest concentration of bird life on the islands. There were times when the air was so filled with wheeling birds that they resembled swarming bees. At other times their numbers almost hid the water from sight.

A boat rarely reached the islands undetected by the gulls. The first birds to sight the craft would raise the cry, whereupon all the bird life within hearing would take wing, following the pickers, screaming and cackling mightily and in the general excitement spattering the luckless eggers from above. Carrying the storage baskets, the men made their way past the "Russian houses," the abandoned huts that had housed the Russian fur hunters a generation before, and clambered up the steep slopes, their progress stirring up clouds of protesting birds. They scrambled over the rocks like goats, picking every egg within reach. As the disturbed murres took flight or scurried precipitously out of caves, the gulls swooped down to snatch up the abandoned eggs before the pickers could reach them. As a defense against this raiding, the men kept together and worked one section at a time.

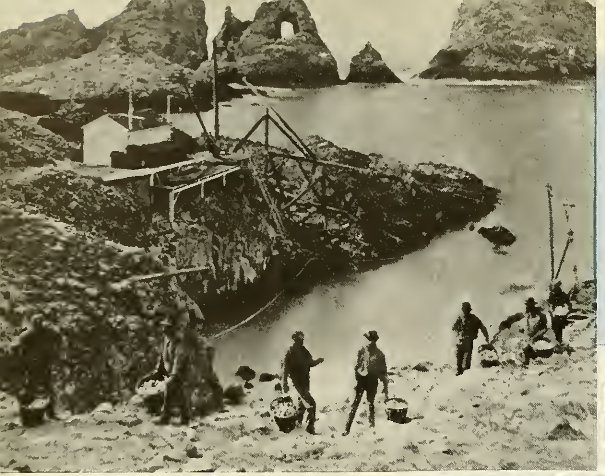
Specially constructed canvas shoes with soles of braided rope enabled the pickers to clamber over the cliffs with some degree of safety. In places, ropes were slung to enable them to reach the more dangerous spots. In spite of the precautions, the egg gathering was hazardous, and those working below had to be on the alert against a dislodged rock. Two men lost their lives off Sugar Loaf in one season. One fell into the sea and was never recovered. The other, James McPalmer, slipped from the highest point on Sugar Loaf Hill, a 185-foot pinnacle, struck several times on the projecting crags, and plummeted into the ocean.

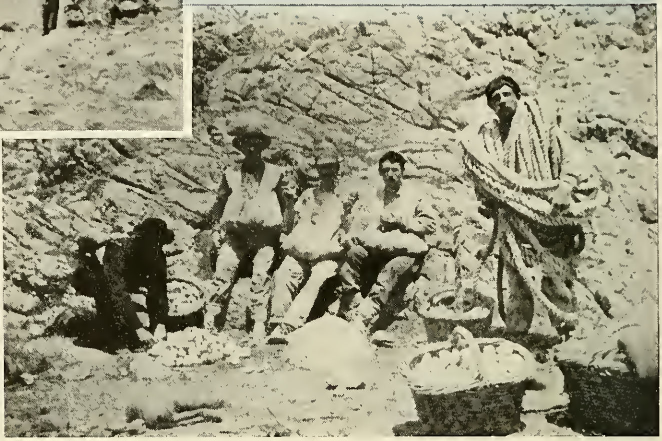
All the eggs within reach were gathered or deliberately destroyed. This was done to ensure only strictly fresh eggs being collected, the eggers maintaining that an egg that had been sat upon for a day was unfit for market. Undesirable eggs, such as those of the cormorant and sea parrot, were scuttled to make room for the nesting murres. The pickers went over the same ground daily and covered the more difficult spots every other day. This ensured the freshness of the eggs gathered—not a difficult task since between the pickers and the gulls, hardly a nest was left undisturbed.

The murre lays its single egg on the bare rock, often without any semblance of a nest. Any spot large enough to support the parent bird is sufficient. The egg is pear-shaped, a fortunate provision since this tends to prevent its rolling off the rock. Instead, the egg only revolves in a small circle when disturbed. It is also deposited under projecting stones, in crannies, caves, and even in old puffin burrows. One egg is the season's quota, if the nest is undisturbed. However, if the egg is pilfered or damaged, the bird will continue to lay as many as six, seven, or eight eggs in a season. The male relieves the female regularly on the nest.

Several pickers would work together as a team, part beginning below and working upward, the rest working down from the summit, meanwhile fighting off the gulls. Each picker wore an "egg blouse," a biblike garment made from cotton flour sacks. The eggs were stuffed into the bosom of the blouse until no more could be held; then the men would clamber back to where the storage baskets were kept. Here the eggs were washed in a tub of sea water, placed in the baskets, and covered with old sacks or seaweed and weighted with rocks to protect them from the marauding gulls. During this process, the frustrated birds circled the baskets at a respectable distance, ready to pounce upon every broken and discarded egg.

The murre guarded the egg with





◄ A VIEW of the egg pickers on the Farallons, from the year 1887. Arch Rock is seen in the background

▼ ANOTHER early view showing the eggers fully equipped for collecting. On some of the steeper slopes, where the murres were safe from other enemies, the eggers used ropes to reach their valuable loot. Today, peace reigns on the Farallons, but the birds have never fully recovered

its life, never exposing it for a second to the thieving gulls. Even the newly hatched chick had to be protected from these winged marauders. The mother bird would remain on the nest until the pickers were practically upon her, then rise with a scream of anguish that startled a thousand or more birds into the air, and scattered filth over the luckless eggers. At times, two or three gulls would contrive to rob a nest that had been left incautiously unguarded for a moment. By feints and jabs, the clever gulls would lure the hapless murre into lunging at them until it exposed the egg momentarily—then one of the gulls would dart in and carry off the egg, pursued by a host of other gulls. Retiring to a distant crag, the bird would ingeniously roll the egg against a rock and crack it sufficiently to insert its beak. If disturbed, it would seize the egg in its beak, take wing, and swallow what it could of the contents, letting the rest fall in a shower on the chagrined eggers.

The gulls were the bane of the pickers. When a colony was invaded and the murres driven from the nests, the air was alive with gulls making away with the eggs and drenching the eggers in filth. So greedy and bold were the birds that they frequently attacked the men.

The pickers and the gulls were not the only foe of the murres; the latter were literally surrounded with enemies. Thousands of sea lions frequented the islands. The young sea lion cubs discovered the palatability of murre eggs and, having acquired a taste for the delicacy, became another factor in the process of destruction. Even the lighthouse crew's work mule that pastured on the island found the eggs an agreeable change from its restricted diet. It hunted eggs eagerly, growing fat and sleek during the laying season.

In the face of these obstacles, one might well wonder how the harassed murres survived the combined onslaughts of man and nature. One bewildered observer commented in 1875: "After the murres have been repeatedly disturbed, many retire to the sea in an exhausted state or flee to peaks and cliffs inaccessible to their human pursuers. But still they suffer from the depredations of the gulls and puffins. It is a mystery how they continue to multiply, as there is no observable decrease in their numbers since they were first driven from the nest in 1850."

The commercial egg gatherers played the sanctimonious role of conservationists whose unselfish practices and far-sighted policy over the years had saved the murre from extermination at the hands of the independent egg pirates. They took care to assure apprehensive naturalists that after 20 years of brutal exploitation, neither the birds nor the eggs showed any signs of diminution. There were still remote crags, they pointed out, where the birds could propagate unmolested. It was also their practice, toward the close of the laying season, to leave a specified percentage of the nests undisturbed to assure the propagation of the species and, by the same token, a future harvest of eggs for themselves.

The prize was too great and too accessible to remain the undisputed monopoly of a few, and more and more the assumed rights of the commercial interests were challenged. As the determination of the contending groups rose, the annual egg battle was revived. Guns began to reappear and heads were cracked. Each season saw the discord grow in fury. The first party to land on the egging ground fought to hold it against all comers, not excluding the United States authorities. Back in 1856, after a series of encounters in which several persons were wounded, the Farallon Egg Company had bought up the fancied rights of the numerous independent groups, while its hoodlum henchmen terrorized the more refractory into submission. For some years the firm dominated the field and comparative peace reigned. With the passing years, the Company grew so arrogant in its self-imposed monopoly that it even denied the lighthouse attendants the right to collect eggs for their own use. The keeper of the light, a Mr. Hess, was discovered with his blouse stuffed with eggs and was manhandled and tumbled down the rocks by the hoodlum hirelings of the commercial interests, making a sorry mess of the eggs and his person. In June of 1863, one rash intruder was killed in a brief skirmish.

Most of the pirates were unnaturalized Italian and Greek fishermen, who devoted the rest of the year to fishing the waters around the islands. As trespassers on United States Government property, these aliens were regularly taken into custody by the revenue cutter that patrolled the islands, only to return as regularly the following season. Frequently they evaded arrest by hiding in Murre Cave while the cutter patrolled the islands. By the summer of 1880, the violence had reached a point where the Government steamer "Manzanita" took the U.S. Marshal, together with 20 militiamen and a commanding officer, to the islands and forcibly ejected the contending groups. The pirates offered no resistance to this armed force, but the U.S. District Attorney who had ordered the eviction was subsequently cited by the egg company for violation of its rights!

The following season saw the final and bloodiest engagement fought on the islands. A schooner with a determined "war party," as they menacingly styled themselves, anchored off the South Farallons one morning with the avowed intention of ending the highhanded monopoly of these commercial gatherers or dying in the attempt. Warned off by the foreman in charge of the picking, the invaders chose instead to fight it out. Like Marines storming a Guadalcanal, three boatloads made a run for the beach. Firing broke out on both sides. With the first volley, one Edward Perkins, one of the shore party, went down, but not without giving a heroic account of himself. Discarding his musket, the fatally wounded man drew a pistol, fired twice, then fell back dead.

Meanwhile, those on board the schooner kept up a steady barrage, rising to fire a volley, then dropping back behind a breastwork of gunnysacks. However, the invasion failed. When four of the attacking party went down under the fire of the defenders, the others begged quarter. Deserting the schooner en masse, they left it as a legitimate prize of war to the victorious shore party.

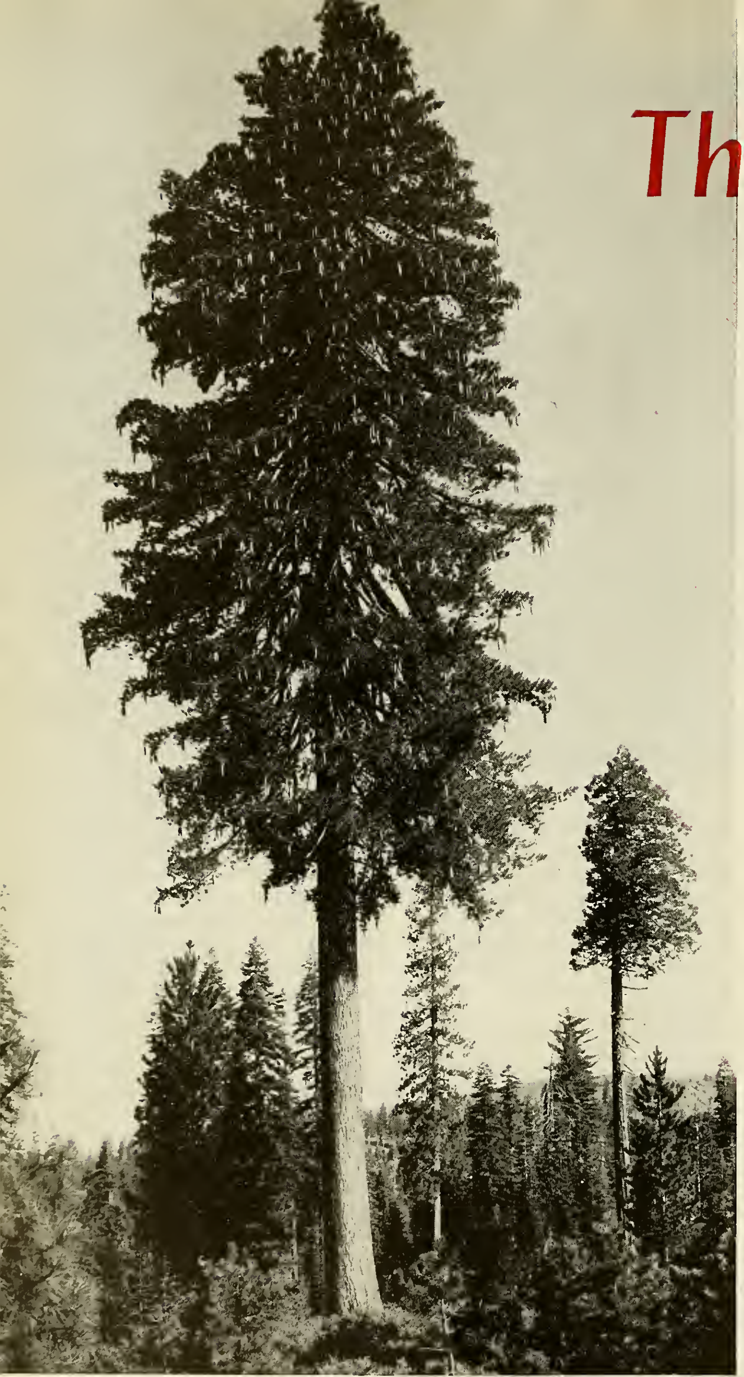
All of this action took place in full view of the revenue cutter "Shubrick," which had been making a routine reconnaissance of the islands and unwittingly found itself in the thick of the engagement. With this fatal affair, the United States Government determined that the time had come to outlaw independent egg collecting on the islands. The Secretary of the Interior accordingly instructed the Collector of the Port of San Francisco to lease the egging privileges to the highest bidder, thus giving the first legal sanction to egg picking and at one and the same time instituting Government control over the picking.

Sadly enough, this last bloody engagement was fought in vain. Shortly after the issuance of the Government's decree, the market for murre eggs broke, and the price dropped to 25¢ per dozen. With the incentive of high prices gone, ambition waned. Charles S. Greene, a contemporary observer, tells that during the season of 1892, less than a dozen men were engaged in the picking. These were now permitted on the islands only with the consent of the lighthouse keeper. It was impressed on them that they were tolerated on the islands only with the sufferance of the United States Government and must conduct themselves accordingly. At the start of the picking season, they were permitted to land and, after being formally ordered off the islands by the keeper, were suffered to remain during continued good behavior—a subterfuge winked at by the lighthouse inspector, who was as relieved as everyone else to see an end to the interminable strife that had rocked the islands for nearly half a century.

The infamous egg traffic is a thing of the past, but the Farallon rookeries have never recovered from the organized raids of the egg pirates. The birds, having been stripped of several million eggs in half a century, as one ornithologist estimated, have never been able, in spite of later conservation measures, to recover from the ravages of those wasteful years.

Today, nobody picks eggs on the Farallons. The islands are used exclusively by the lighthouse service. Since they lie in the direct sea route between San Francisco and Hawaii, the light is one of the most important on either of our coasts. The only visitors are naturalists, investigating the islands' teeming bird and marine life, and geologists who probe into the islands' very foundations. The rocks are now a wildlife sanctuary, and the marine mammals and seafowl gambol and wheel to their hearts' content, safe from the brutal exploitation that made survival a touch-and-go affair for so many years.

The Suga



Rognon Studio picture from Western Pine Assn.—A.F.P.I. photo

▲ THIS LONE GIANT and scattered trees in the background were left in a selective logging process to provide seed for new growth. Note the hundreds of cones hanging from its boughs

THE great genus of the Pines stretches around the North Temperate Zone and on mountains far into the tropics, and numbers some 80 to 90 species. Many of them are of the highest usefulness or the greatest beauty, and many of them attain splendid proportions. But there is one species, the Sugar Pine, that towers above them all. It is the king of Pines, undisputed in its monarchy over all others.

In magnificent dimensions the Sugar Pine ranks after the two Sequoias, the Sitka Spruce, and the Douglas Fir; it is, therefore, the fifth greatest of all American trees in size. A specimen standing today in the Stanislaus National Forest, California, is 246 feet high and has a trunk circumference, at breast height, of 31 feet 8 inches. Some of its neighbors in the mountains of California are almost as tall and mighty of bole, and it is quite possible that before the lumber mills began, over a century ago, the whirlwind destruction of the finest of accessible stands of Sugar Pine, there were other specimens larger still.

A grand old Sugar Pine 200 or 300 years old can stretch out its lower limbs high above the heads of many other species—the Incense Cedars, the Mountain Hemlock, the Ponderosa or Western Yellow Pine, and the Firs. Even in the company of the Giant Sequoias, or Big Trees, the Sugar Pines are not dwarfed but stand as worthy associates of the largest and oldest living things on earth.

As you mount the western slopes of the Sierra Nevada, you first meet the Sugar Pine at altitudes as low

Pine

The mightiest of the Pines has withstood the ages, but a tree of such singular qualities has all but met its match in man's haste to loot the treasures of nature

By Donald Culross Peattie

as 2000 feet in the north, but in the southern Sierra it scarcely occurs below 6000 feet, and on the high mountains of Southern California it is first seen at 8000 feet and ranges up to 10,000 feet altitude. It thus occurs in what are the most grandly forested portions of this great mountain range, where the rainfall is in the neighborhood of 40 inches and the snow at times may lie 12 feet deep. But in summer, which is the dry season, this is the most enjoyable part of the Sierra Nevada—a region of open groves with very little underbrush but a wealth of wild flowers and small flowering shrubs. Here mule deer step proudly and unafraid through the groves of the Sugar Pine; a lumbering bear goes by, intent on his business and not in the least hostile to man; the Douglas squirrel dances and chitters on the boughs perhaps 100 feet overhead, the needles are deep underfoot, and views of snowy peaks, canyons, and waterfalls open at every vista of the groves.

In this magnificent setting, the Sugar Pine is at home. Its mighty boles rise straight as the shafts of columns but are colored a rich purplish brown and livened with tufts of the yellow-green staghorn lichen. The incense of its needles and resinous exudations fill the aisles of this forest temple. Overhead the majestic crowns of the Sugar Pines just touch each other, making a vaulted roof that is airy and full of light. Everywhere is a sense of light and space, of hope and time—time enough to grow a kingly tree, a long time that has gone before you, to clothe a mountain range thus nobly.

Young Sugar Pines are much alike in their slender, close-grown, conical form. In winter their youthful limbs easily shed the snow and do not break under it. Before the season is done, the drifts may have sifted so high that the little trees are buried many feet beneath, and many tons of weight may lie upon them. Yet the snow is the friend of these trees, for, softly but firmly encasing them, it keeps them for months of the year in a rigidly upright position, so that a crooked stem is almost never seen in a Sugar Pine. Once started straight, the tree, as it grows older, is able to keep the martial *tenue* it gained in youth. The lower branches are self-pruned as the young groves grow older, with the result that no other Pine in the world shows less limbage or a longer bole clean of branches. At the top of the long stem, an old Sugar Pine bears a palmlike crown, though grander than any true palm's, for the lowest limbs may be 40 feet in length—very fair trees in themselves, were they cut off and set upright.

As it ages, the Sugar Pine exhibits endless eccentricities. No two old

▼ MANY OF THE CONES of the Sugar Pine are eighteen inches long, some more than two feet

Jack Dermid photo

trees look alike; each is an individualist of the most rugged sort, grandly asymmetrical, disdaining the prettiness, the uniformity of Fir tops or the winsome nodding of the tips of Hemlock. Instead, an old Sugar Pine's crown looks storm-racked but indomitable, sometimes almost absurdly sprawling or overreaching.

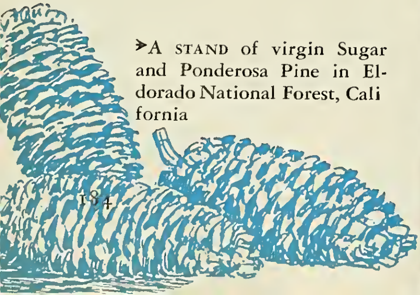
Yet this tree has its grace; for from the underside of the foliage hang the swaying, slender cones, fifteen to eighteen inches long, green shaded with dark purple on the sunward side. One cone even 26 inches long has been measured. After the cones ripen in September and October, their scales open and the winged seeds slip forth upon their errand through the forest. Now the color of the scales alters to a warm yellowish brown, and many of the cones remain swinging in the wind all winter and through the following summer. Fallen, at last, on the forest floor, they are still so big and beautiful that he who wanders through a Sugar Pine grove for the first time is almost certain to pick up the first few cones he sees, convinced that he has come upon specimens of an unusual size. But he soon discovers that the woods are full of them, and he drops his armful back to earth, conscious that he is in the presence of treasure so bounteous

Josef Muench photo

▲ THREE QUEENS: a trio of Sugar Pines dwarfing the man-made fence of split rails that is probably several hundred years younger. A view along the Old Wawona Road near Yosemite National Park

Fred Funke photo from U.S. Forest Service

➤A STAND of virgin Sugar and Ponderosa Pine in Eldorado National Forest, California



Josef Muench photo

▲ A FINE SUGAR PINE enhances this view of the Great Western Divide seen from Moro Rock in Sequoia National Park

that he need not carry away any; that all he has to do, to be rich in the best things of earth, is to stay where he is, to breathe this air, to hear the sound of the wind in those great singing crowns, and rest his hand upon the serene boles.

It was the half-inch seeds or the enormous cones of this tree that led to its first discovery by science. We have it on the word of Athelstan George Harvey that David Douglas, pioneer botanist of the Northwest, was shown a single cone of this tree when he was in the Willamette Valley in 1825, and he also saw the sweet-tasting seeds, which the Indians carried in their pouches for food. So great a cone could only come from a great tree, he reasoned, and with this single cone as his clue, he set off from Fort Vancouver on September 20, 1826. Then the present states of Oregon and Washington were under the British flag, holding few white settlers outside the forts; and Indians and grizzlies roamed a land unknown, unmapped, unspoiled. Now let him tell his own story, which he wrote by the flickering light of a Pine torch, on what is now Sugar Pine Mountain, just west of Roseburg, Oregon:

"THURSDAY, 26TH. I left my camp this morning at daylight. . . About an hour's walk from my camp I was met by an Indian, who on discovering me strung his bow and placed on his left arm a sleeve of racoon-skin and stood ready on the defence. As I was well convinced this was prompted through fear, he never before having seen such a being, I laid my gun at my feet on the ground and waved my hand for him to come to me, which he did with great caution. I made him place his bow and quiver beside my gun, and then struck a light and gave him to smoke and a few beads. With a pencil I made a rough sketch of the cone and Pine I wanted and showed him it, when he instantly pointed to the hills about 15 or 20 miles to the south.

"As I wanted to go in that direction, he seemingly with much good-will went with me. At midday I reached my long-wished *Pinus* (called by the Umpqua tribe *Natele*), and lost no time in examining and endeavouring to collect specimens and seeds. New or strange things seldom fail to make great impressions, and often at first we are liable to over-rate them; and lest I should never see my friends to tell them verbally of this most beautiful and immensely large tree, I now state the dimensions of the largest one I could find that was blown down by the wind: Three feet from the ground, 57 feet 9 inches in circumference; 134 feet from the ground, 17 feet 5 inches; extreme length 215 feet.

"The trees are remarkably straight; bark uncommonly smooth for such large timber, of a whitish or light brown colour, and yields a great quantity of gum of a bright amber colour. The large trees are destitute of branches, generally two-thirds the length of the tree; branches pendulous, and the cones hanging from their points like small sugar-loaves in a grocer's shop. . . .

"Being unable to climb or hew down any, I took my gun and was busy clipping them from the branches with ball when eight Indians came at the report of my gun. They were all painted with red earth, armed with bows, arrows, spears of bone, and flint knives, and seemed to be anything but friendly.

"I endeavoured to explain to them what I wanted and they seemed satisfied and sat down to smoke, but had no sooner done so than I perceived one string his bow and another sharpen his flint knife with a pair of wooden pincers and hang it on the wrist of the right hand, which gave me ample testimony of their inclination. To save myself I could not do by flight, and without any hesitation I went backwards six paces and cocked my gun, and then pulled from my belt one of my pistols, which I held in my left hand. I was determined to fight for life. As I as much as possible endeavoured to preserve my coolness and perhaps did so, I stood eight or ten minutes looking at them and they at me without a word passing, till one at last, who seemed to be the leader, made a sign for tobacco, which I said they

Josef Muench photos

▲ **A SEA OF CLOUDS**, rolling in white waves into inlets, almost inundates the forest of Sugar Pines that stands on the green crests of the San Joaquin Valley. A view from towering Moro Rock in Sequoia National Park

should get on condition of going and fetching me some cones. They went, and as soon as out of sight I picked up my three cones and a few twigs, and made a quick retreat to my camp, which I gained at dusk. . . The position I am now in is lying on the grass with my gun beside me, writing by the light of my Columbian candle—namely a piece of wood containing rosin."

The Sugar Pine takes its name from its sweet, gummy exudations. "The sugar," John Muir explains, "is to my taste the best of sweets—better than maple-sugar. It exudes . . . in the shape of irregular, crisp, candy-like kernels, which are crowded together in masses of considerable size, like clusters of resin-beads. When fresh, it is perfectly white and delicious, but, because most of the wounds on which it is found have been made by fire, the exuding sap is stained on the charred surface, and the hardened sugar becomes brown.

"Indians are fond of it, but on account of its laxative properties, only small quantities may be eaten. Bears, so fond of sweet things in general, seem never to taste it; at least I have failed to find any trace of their teeth in this connection." The sugar in this resin is said to be as sweet as cane sugar but belongs to an entirely different class of the sugars, known as pinitol. If you are a chemist it may mean something to you to learn that pinitol is a monomethyl ether of dextro-inositol.

No other Pine in the world has so long a trunk clear of limbs and with very little taper. Taken all in all, the delightfully fragrant wood, with its lightness, satin texture, close grain, ease of working, and ability to take a fine polish make it an outstanding favorite among pines. And no others produce so much in a given area. Owing to the size of individual trees, small areas are known to yield 100,000 to 200,000 board feet to the acre. So it is not surprising that from the earliest days of settlement in the Sierra foothills, the Sugar Pine was cut in preference to any other. Indeed, it was to cut Sugar Pine that John Sutter set up his famous mill at Coloma, where gold was discovered on a momentous day in 1848. And when the sudden influx of settlers brought a great demand for house timbers and shingles, the Sugar Pine answered best of all. Sugar Pine roofed the shacks of the forty-niners and their followers and descendants.

The first shingles were, more exactly, shakes; that is, split, unshaved pieces of wood usually 30 inches long and from 4 to 6 inches wide, and often only ¼ inch thick, rived out by hand. Those early shakemakers were experts with the cleaving tool known as the frow, but they were wastrels in the way they used this precious wood. Trees that would have sawed out at 10,000 or 20,000 feet of lumber were cut down by the shakemakers and oftentimes left to rot in the woods if it was found that their splitting properties were less than excellent. And even when they were outstandingly good, usually more than half of the tree was wasted. The shakemakers would go up in parties of two to four and make a camp in the pineries to spend the summer. Without stirring more than 300 yards, they could provide themselves with a season's work, for 4 or 5 giant Sugar Pines sufficed. Needless to say, these were all stolen trees. Any sort of tree on Government land was then considered to be the property of him who could get to it first and cut it down.

But though shakes might roof the early houses of California and provide siding, too, large buildings and barns demanded structural timber, and so the sawmill early made its appearance. Sugar Pine was sawed, in the days of the forty-niners, for flumes, sluice boxes, bridges, houses, barns, fences, and mine props. Like the shakemakers, the pioneer millmen simply stole the Government's trees, and soon more Sugar Pine was being cut in the Sierra than all other woods combined, for it was lighter and softer than the Ponderosa or Western Yellow Pine, its nearest rival. Before railroads brought in lumber from other regions, ox teams were toiling up steep grades to altitudes of 4000 to 6000 feet and hauling off Sugar Pine for building and fencing material from the mountain mills to treeless valleys below, for a distance of as much as 100 miles. At the same time, the old shakemakers were giving way to shingle mills, only a little less wasteful than the crew they had displaced. Then, as the fruit industry developed in the Sacramento Valley, Sugar Pine was cut for orange and raisin boxes. Sugar Pine wood, because it is so light and handsome and because it does not impart its own flavor to the contents, has remained the ideal packing box for fruits.

As the White Pine of the East began to give out toward the end of the last century, Sugar Pine, instead of western White Pine, came to replace it. For it has about the same weight per cubic foot and is sometimes considered preferable to White Pine for doors and sliding sashes, since it shrinks and swells even less and holds its shape better. White Pine was long considered the one ideal wood for patternmaking, but Sugar Pine matches it today. Planing mills utilize it for moulding and panels, railing and stairwork, doors, sash, blinds, and the decking of boats. Because of its freedom from odor, it is used for the compartments in which to store coffee, tea, rice, and spice, and for druggists' drawers. Its straight grain qualifies it for service as the pipes in church organs, a role in which comparatively few woods are at all satisfactory.

The Government, when roused to its duty by the stinging words of John Muir, at last began to take charge of its own forests in the Sierra Nevada, and the first thing it did was to turn out the wandering bands of shakemakers. Its struggle with the sheepherders was longer. It had been their wont to build corrals on the edges of the meadows by felling Sugar Pines in such a way that, stretched at length on the ground, they made a huge triangular or circular enclosure—all this, of course, as a trespass

➤ Sugar Pines decorated with snow adorn this road to Badger Pass Ski Area in Yosemite National Park in California upon Government land. Longest of all was the battle with the cattle ranchers, who similarly had for years been dropping Sugar Pine logs end to end to make fences to turn cattle. Regarding themselves as lords of the land, as pioneers who had won their way, as tenders of a vested interest with precedence over any other interests, they went armed and took orders from government foresters only a little more respectfully than they would have taken them from sheepherders. Decades of tact, education, patience, and firmness were required to bring about the present and still precarious balance among the interests of the sheepherders, the ranchers, and the foresters, on the Forest Service's own lands.

And, even now, by far the largest part of the stand of Sugar Pine in California and Oregon is out of the Government's hands and in possession of lumber companies or private individuals who might sell whenever the stumpage price goes high enough. The National Parks and the National Forests can save the magnificent groves of Sugar Pine when these fall within their boundaries. But the countless visitors who each year motor or climb through the Sierra Nevada seldom realize that some of the Sugar Pines they most admire are not within the jurisdiction of the Government and that their destiny is the sawmill—if not next year, then ultimately.

Knowledge of this fact rouses the emotions of us all, and it is meet and right that groves of great antiquity and beauty should be included in the bounds of National Parks and National Forests whenever possible. It is also right and necessary that there should be a lumber industry, and that a tree of such high utility as this one should be selectively harvested in a scientific way so as to permit a sustained yield from one generation to the next. Unfortunately, that goal has not been reached yet by most lumber companies in the Sugar Pine region, and with some it is not even an ideal. At the present time, the cut is still well in excess of the natural replacement, and until the two come into balance we can expect only increasing destruction of this superb tree, and a corresponding rise in the price of its fine lumber.

LETTERS

Continued from page 146

such as the giant redwoods. The lust of our public officials for money makes us suspicious of their business methods. . . . My 83 years of life, spent mostly in the great open spaces, have given me a great admiration for trees. I have seen the forest of Maine vanish and the streams dry up. In spite of a good system of fire protection in the future, our woodlands will burn over because the open country will become so dry. The pulp companies and insects have taken most of our softwoods, and now they are taking the hardwoods. Roads reaching far back into the woods add a fire hazard from careless hunters and fishermen. Waste of our resources should be stopped.

R. G. Leonard

Hampden, Me.

Sirs:

. . . I want to add my voice to the ones that are really serious about wanting not just some but a really large part of our Forests preserved. I have spent a lot of time in our Forests and know something of the slaughter of timber that is taking place. After driving thousands of miles in these Forests and watching them try to recuperate from this harvest, I have decided that the recovery period will have to be measured in hundreds of years. . . .

E. A. Biddison

Newcastle, Wyo.

Sirs:

. . . The administration of our National Parks and National Forests has been a concern of our family for years. . . . With increasing alarm we note and protest against encroachments on these unique and/or unspoiled areas.

As a director of the Cambridge League of Women Voters (nationally representing over 98,000 women I had the satisfaction of helping to incorporate the study and action for more efficient government management of our national resources, as one of three main items on our current two-year program. So, indeed, I welcome this opportunity to press further with you the question of which 2½ per cent of our land is to be preserved permanently—and how?

Mrs. G. W. Cottrell, Jr.

Cambridge, Mass.

Sirs:

Do continue to do everything possible to preserve our Forests. "Let Grow!"

Mrs. Richard Derby

Oyster Bay, N. Y.

Sirs:

. . . I wish to register my own conviction that we owe it both to our traditions as Americans and to the welfare of future Americans to preserve our finest forests as wilderness areas, uncontaminated even by "selective lumbering." I believe that if the "brave new world" of the future is to be worth living in, man must impose limitations on the amount and areas of national resources each generation may enroach upon. He must then make the necessary adjustments to keep within those limits, regardless of what population or economic pressures may beset the times. . .

The carelessness and indifference of preceding generations still cast a shadow across our times, for they were responsible for eliminating . . . resources whose passing has impoverished this country for all time to come. If we intrude into every wilderness area, some of which must be preserved in their natural state if our descendants are to comprehend the true magnificence of their American heritage, we in turn are tampering with spiritual and natural resources of the future on which we have no moral right to leave our mark.

Best wishes to you and other conservationists who are endeavoring to awaken the public to the necessity for immediate action to save our forests.

Catherine A. Hurlbutt

Denver, Colo.

Sirs:

. . . It seems a shame that so much timber in our National Forests should be allowed to be cut each year. I feel that the trees in our National Forests should be allowed to grow and be protected by Federal law . . . except for those that are dead or diseased. . .

John E. Hoffman

Schenectady, N. Y.

Sirs:

. . . Although I have a great personal respect for the Forest Service from fairly intimate acquaintance with them . . . I still feel greatly disappointed that they seem to feel such diffidence in their ability to find and discuss their finest areas. . . . The owners of the Forests have a right to know where the finest timber areas in these Forests lie. And *we* are the owners. I speak for many of my friends when I say that we would, indeed, like to know. . .

RICHARD J. GORDON
Kenosha, Wisc.

SIRS:

. . . We support your stand on "Cut or Let Grow?" Forests must be managed so that they grow properly, which means planned cutting; but I don't see why heavy commercial cutting needs to go on continually in our National Forests. . .

LEE BURT
Wilmington, Del.

SIRS:

I am one who cares about cutting of forests and conservation of virgin stands. My chief hatred and disgust is for those who would build endless *tourist* roads through our remaining mountains and forests. Keep up the fight, and good wishes.

T. V. W. CARPENTER
Los Angeles, Calif.

SIRS:

. . . We have so little left! Is there any way in which those interested in conserving all that remains can make that interest effective?

J. H. M. PARKER
La Jolla, Calif.

SIRS:

. . . I agree with you that the Forest Service gives more data on cutting than on preserving, and it is not encouraging.

I think you should publish facts as to which stands are in danger of the unholy depradations of lumber interests and tell readers what they could do to protest. . .

I lecture on "You and Your Government" and always hammer on conservation. . .

MRS. S. L. M. BARLOW
New York, N. Y.

SIRS:

. . . I feel dismayed at the number of sawmills kept busy in the midst of the National Forests. . . . It also seems unfortunate that there are privately owned lands within the National Forests.

I do not know how widely advertised would be any intention to cut timber in a Wilderness Area so that a public protest could be made.

It is well that some interest is being taken in conservation.

CLARA M. BEALE
Walpole, Mass.

SIRS:

I write to commend you for your article concerning our Forests . . . and heartily support your editorial views. . .

I sincerely hope you and your friends realize some satisfaction in stopping this foolhardy policy of "cut today and so what about tomorrow?".

BAILEY BROWER, JR.
Madison, N. J.

SIRS:

. . . You invited the readers of NATURAL HISTORY to tell if they really care about our Forests. Here is one who certainly is interested. The writer is an ardent believer in conservation of our Forests and wildlife.

As one citizen among many thousands, I can't hope to do much. But if the readers of NATURAL HISTORY alone would support a program through the representation of the American Museum, we might accomplish something not only of value to this generation but for those who will follow us. . . .

The writer is only a recent subscriber to your Magazine, but she finds it the best and most looked-forward-to periodical that she reads monthly.

FRANCES R. JOHNSON
Denver, Colo.

SIRS:

I desire to state categorically and unequivocally that I believe that *at least* 2½ per cent of our land should be preserved as forests! . . .

The areas to which an individual may go to leave behind people-in-the-aggregate and motor exhaust fumes are diminishing rapidly, pointing up the reasons why it is imperative that as large a percentage of our land as possible be preserved in its wilderness state. . .

DONALD K. TEAD
New York, N. Y.

SIRS:

. . . I believe that letting our forests grow to the greatest possible extent is one of the most important things for the future of our country. There are already too many man-made deserts.

MRS. H. PUGH
Burlington, N. J.

SIRS:

I agree that the forests need to be preserved. . . .

HILDA MOORE
Woodhaven, N. Y.

SIRS:

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The Screen

Authentic comments on films in the field of nature, geography, and exploration

Edited by Elizabeth Downes

"The Olympic Elk"

"THE Olympic Elk," Disney's latest addition to his series of nature films, which includes "Seal Island," "Beaver Valley," and "Nature's Half Acre," has just been released. Everyone who enjoyed "Snow White and the Seven Dwarfs" will be glad to know that this latter film is playing with "The Olympic Elk." To find fantasy so real that it seems like fact, or fact so charming that it seems like fantasy is an unusual experience; but to have both of these combined in one motion picture program is very rare indeed.

"The Olympic Elk," which runs for about 30 minutes, takes the viewer to the beautiful wilderness of Olympic National Park in the State of Washington. The story told is that of the animal life cycle of the elk, which live in the forest and upland areas of the Olympic Peninsula across Puget Sound from Seattle. Each summer the elk, traveling in herds, migrate from the low rain forest to the highlands, where they will graze, breed, and find protection for their young in the cool solitude until winter returns. Photographers for Disney, Mr. and Mrs. Herb Crisler, trailed the elk for two years, catching remarkable color shots of every aspect of the elk's life cycle—from the time the calves first steady their wobbly legs in the low rain forest until they dance and romp in the snowbanks of the towering crags. There are vivid shots of the bulls' desperate struggle to gather and maintain harems. The picture ends when the herd starts off on its return migration to the rain forest below, thus completing the yearly cycle.

In pleasing contrast to the main theme, the viewer is shown close-ups of lively marmots engaging in a boxing contest, mountain goats passing over the rocks, and the beautiful alpine wildflowers of the highlands. Mountain lilies are seen thriving in the snow and watered by icicles that drip on them.

We have secured expert comment on this motion picture from Dr. Harold E. Anthony, distinguished mammalogist, explorer, and writer. He has visited this area and has also flown over it when the elk were in the meadowlands. "A great motion picture," says Dr. Anthony, "calls for an interesting theme, excellent photography, competent direction, and the proper dialogue and sound effects. Walt Disney has pioneered in the successful dramatization of factual natural history, and this new addition to his series lives up to the high standard he has set.

"The Olympic Elk is a magnificent animal with an interesting life-history; its home range is one of the scenic wonderlands of this country; the pictorial record is superb photography; the scenario is logical and well-balanced; the commentary is lucid and adequate; and, finally, the sound effects add greatly to the realism.

"This film is highly entertaining and instructive. It teaches a love and appreciation of nature. Unlike some things that are good for us, it requires no effort to 'take' this entertainment. On the contrary, I doubt if any one who sees this picture begin can be dragged from it before it closes. I predict a very popular reception for 'The Olympic Elk.'

"There is an ever-increasing demand upon the natural resources of our country. The pressure to cut the forests, to dam the streams, and to change the face of nature is tremendous. The public should be educated to a proper evaluation of all the factors to the end that man's economic and spiritual needs may both be realized."

A TITANIC BATTLE between two bulls in Disney's "Olympic Elk"

Mr. Richard H. Pough, Head of the American Museum's Department of Conservation, says of this film, "At last, through the initiative of Walt Disney and the medium of color film and sound recording, the public is being given an opportunity to enjoy the matchless beauty and exciting drama of wild country that is still largely unknown except to naturalists. To some, it will undoubtedly serve as a stimulus to see this extraordinary area and its wildlife for themselves; but for most Americans it will provide a means of vicariously enjoying an area that they could probably never hope to penetrate.

"If the areas we as a nation have set aside to be preserved as wilderness can continue to provide settings for pictures like these that permit the country's movie-goers to enjoy their wonders, it will go far to answer the objections of those who claim that only one person in a thousand will ever be able to visit and enjoy them."

Dr. Charles Russell, long of the American Museum's Department of Education, and one who realizes the value of the motion picture in portraying natural history subjects, comments: "This is a superb color picture of a dramatic cycle of animal life in a naturally limited area, which can be easily visited by travelers. The photography is exceptionally good, and the sound well chosen and edited, carrying forward with the mood and the action. It is an exciting story well told but, for purposes of rounded learning, not completely told. A picture of this type is exciting realism, rarely possible of observation, even by students. For students, however, the incompleteness is important. One of the more dramatic and least well-known aspects of the life of the deer family is the growth of the antlers, the development and loss of the velvet, and the final shedding. Since this process is so intimately connected with and in part a control over the actions of the elk that are pictured, it would have been a better educational picture if somewhat extended. As it is, it is the best that I have seen."

Francis Kee Teller, the seven-year-old Navajo star of "The Navajo"

"The Navajo"

Many highly artistic documentary films have been made, but they very often have a limited distribution. We are told that "The Navajo," a full-length picture just released, will have nationwide distribution. Dr. Harry Tschopik, Jr., who has lived among the Navajo Indians and has had wide experience with the problems of primitive man in contact with white civilization, writes:

"In several respects 'The Navajo' is an extraordinary documentary film. It was photographed in its totality in the vast deserts and canyons of the Navajo reservation in northeastern Arizona, without benefit of artificial settings or props. For all intents and purposes the cast is limited to seven individuals, five of whom are full-blooded Indians, who neither spoke nor understood a word of English, and were directed through an interpreter. The leading character is a seven-year-old Navajo boy who, prior to this performance before the camera, had seen but one white man in his life and who, consequently, gives a marvelously convincing portrayal of a frightened little boy trapped in what appears to him to be a strange and hostile world.

"The film makes no pretense at documenting Navajo culture in its entirety, although details of Navajo belief, custom, and history are introduced in a casual, realistic manner whenever they are pertinent to the plot. Instead, the story focuses upon the dilemma of a small boy caught between two very different, and traditionally antagonistic, ways of life.

"The boy lives with his mother, sisters, and old grandfather, who is a medicine man, in a well-watered tract of the Navajo country. When, because of evil omens, the grandfather persuades the family to move their encampment to a less favored region, the child accepts this uprooting without question. Misfortune befalls the family in their new surroundings. The water hole dries up, a drought kills the sheep, and finally the grandfather dies; all these hardships the boy endures as natural events in the Navajo scheme of things. But when he is 'captured' by white men who force him to attend their school, he rebels against these traditional enemies and escapes, only to find his home burned down and his family wiped out by disease. Followed by his white instructor and a Ute interpreter, the frightened little boy, determined to remain free, makes his way into the chasm of the Canyon of Death, where many a Navajo before him had fled in times of trouble. Here he traps his pursuers on a cliff ledge and leaves them to die, until, remembering the wisdom of his kindly old grandfather, the boy goes off to the trading post for help.

"This simple story is unfolded, principally through narration, in a direct, straightforward manner. It carries the conviction of truth because much of it has unquestionably happened, time and again. Norman Foster, who wrote and directed the film, never preaches. He neither romanticizes the Indian nor does he blame the Government Indian school, save indirectly and by implication. The schoolteachers, Indian and white man alike, are presented as kindly, well meaning, and sympathetic. Yet one cannot help wondering how the stress placed in these schools upon bodily cleanliness and the use of electrical appliances is intended to benefit the Navajo child who must eventually return to his primitive home in the semiarid desert where water is priceless for mere survival, and where the nearest electric current is miles away, or beyond his means even if available.

He learns Indian lore from his grandfather

At the Indian School he resents his white-boy haircut

The Boy and a sympathetic teacher

"The photography, under the direction of Virgil E. Miller, is sensitive and dramatic, making the most of the breathtaking scenery. There is a fine double twist in setting the climax of this story in Canyon del Muerto, where the Navajo once resisted the white man and were disastrously defeated. Leith Stevens has written an exciting, disharmonic musical score, suggestive of Indian music, but not based directly upon it. The outstanding credits, however, go to Francis Kee Teller, the beautiful, big-eared Navajo boy, and to producer Hall Bartlett and writer-director Norman Foster who, as a team, may well fill the shoes of the late Robert Flaherty."

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* See page 158, Feb. 1951 issue of **Mechanix Illustrated,** for spotting scope plans using this lens.

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BOOKS *Continued from page 151*

of the pollens causing the hayfever. It is true, the author points out, that the new antihistaminics are without question the most important contribution to the treatment of the symptoms of hayfever since the introduction of epinephrine and ephedrine. The most important of them are listed and their merits discussed. As palliatives, the doctor says, they are superb, but as substitutes for hyposensitization they are of little value and may be quite dangerous. They have a tendency to lull the patient into a false sense of security while his hayfever grows steadily worse, perhaps leading to sinusitis, seasonal or chronic asthma, and other complications.

One may escape from hayfever by running away from it. This method is frowned upon by the author, but he says that if the hayfever victim is going to run, let him at least know the facts before he picks his direction. For the facts, the reader is referred to the tables of ragweed data, reprinted from the National Pollen Survey, compiled by a committee of that name, of the American Academy of Allergy. These tables give the pollen indices for cities, towns, and resorts throughout the United States and adjoining territory.

Roger P. Wodehouse

Migration of birds

- - - - - - by Frederick C. Lincoln

Doubleday, $1.00, 102 pp.

STUDY of bird migration in the United States has long been associated with the U. S. Biological Survey or, as it is now called, the Fish and Wildlife Service. As director for many years of this bureau's activities in bird banding and distribution, F. C. Lincoln is a recognized authority on the migrations of our birds. This little book, the last of several he has written on the subject, is well worth its modest price to anyone desiring a general survey of the migrations of North American birds. Ingenious migration maps, drawn by Bob Hines, contribute greatly to its value.

Of recent years, research in migration has been largely concerned with its causes and physiological controls and with the problems of homing and avian navigation; this recent work is, of necessity, only briefly summarized by Mr. Lincoln.

D. Amadon

WINGS UNDER WATER *Continued from page 163*

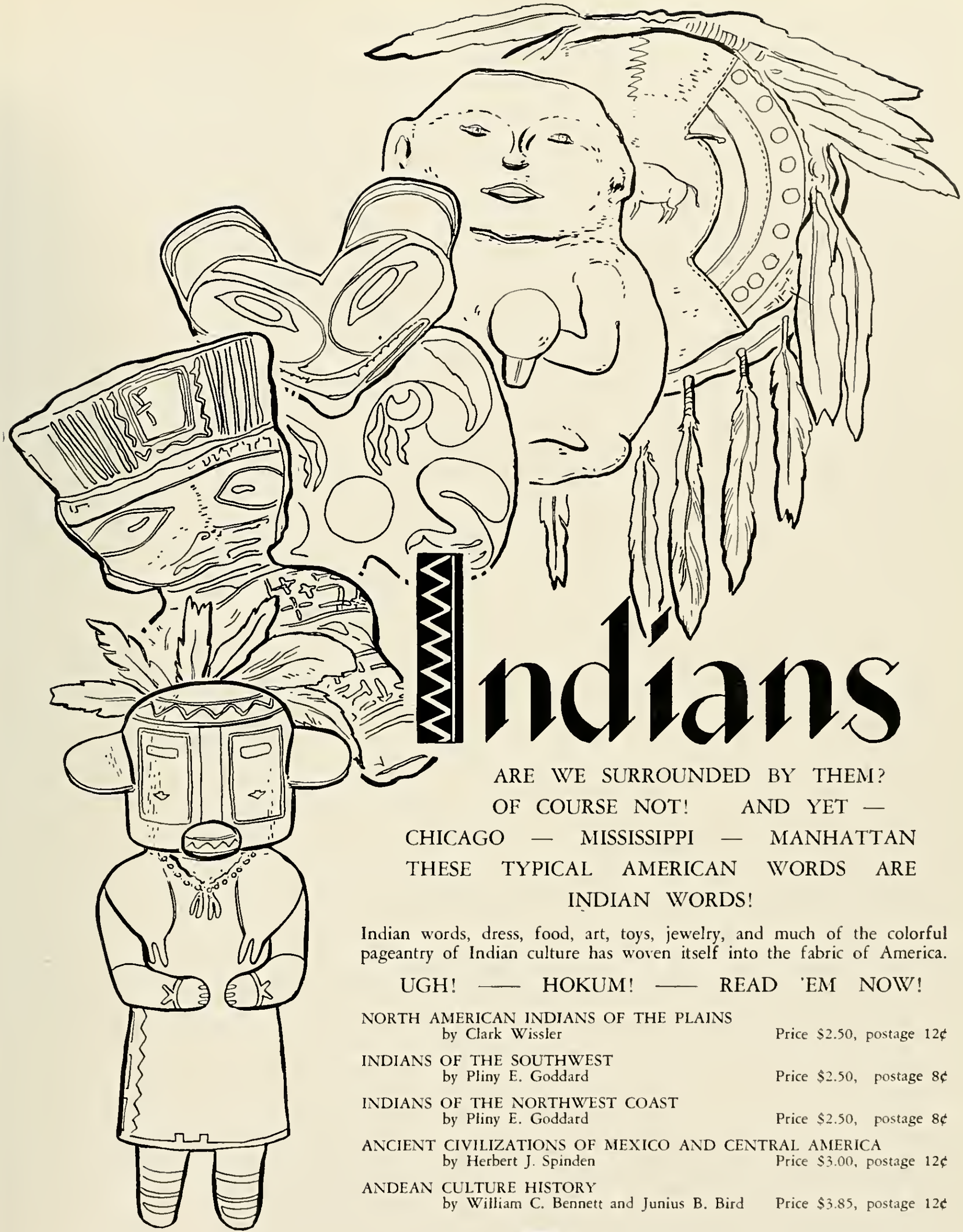
but for a still flightless bird he took them all in good stride. In going over short falls he was completely buried in the white froth. At the bottom of the falls he was trapped in the circular undertow and rotated up and down like a bobbing cork. Once loose from this, he became snared in a whirlpool, only to be released for a partially submerged ride through more rapids.

When he finally succeeded in going ashore at the bottom, he was a much-bedraggled water ouzel. But in no time he had limbered up his leg springs and was bouncing up and down merrily and yelling for food as his parents flew by.

Even in winter, the dipper remains a hardy mountaineer, indifferent to cold and impervious to it. His thick, downy underwear acts like a thermos bottle to keep the warmth in and the cold out. As snow and ice clog the upper streams, the dipper moves down into the valleys for open water. There, though the water is speckled with a bluish sludge of soft ice and though the thermometer is far below zero, the dipper gaily dives in for food. These polar ventures are stopped only long enough to allow the ouzel to perch on a cake of ice and decorate the frosty air with its gurgling melody.

On early winter mornings dippers stop regularly to take sun baths in the warm alpine light. On cloudy mornings, dippers in Yellowstone National Park have discovered an ersatz sun bath: they warm themselves and bask luxuriously in the steam from the superheated geyser waters.

Winter or summer, it seems as though the dipper just can't revel enough in its mountain torrents. After a few minutes of clowning and working for food in the stream, what could be more refreshing and invigorating than a bath! And the dipper goes all out to take a bath. First there are the "showers"; the bird darts toward the stream, hits the surface, and skids along for three feet with its head under and with water rushing over its back. Next it stands in shallow water and flutters in approved birdbath fashion. And then off again for food among the beaten foam bells!



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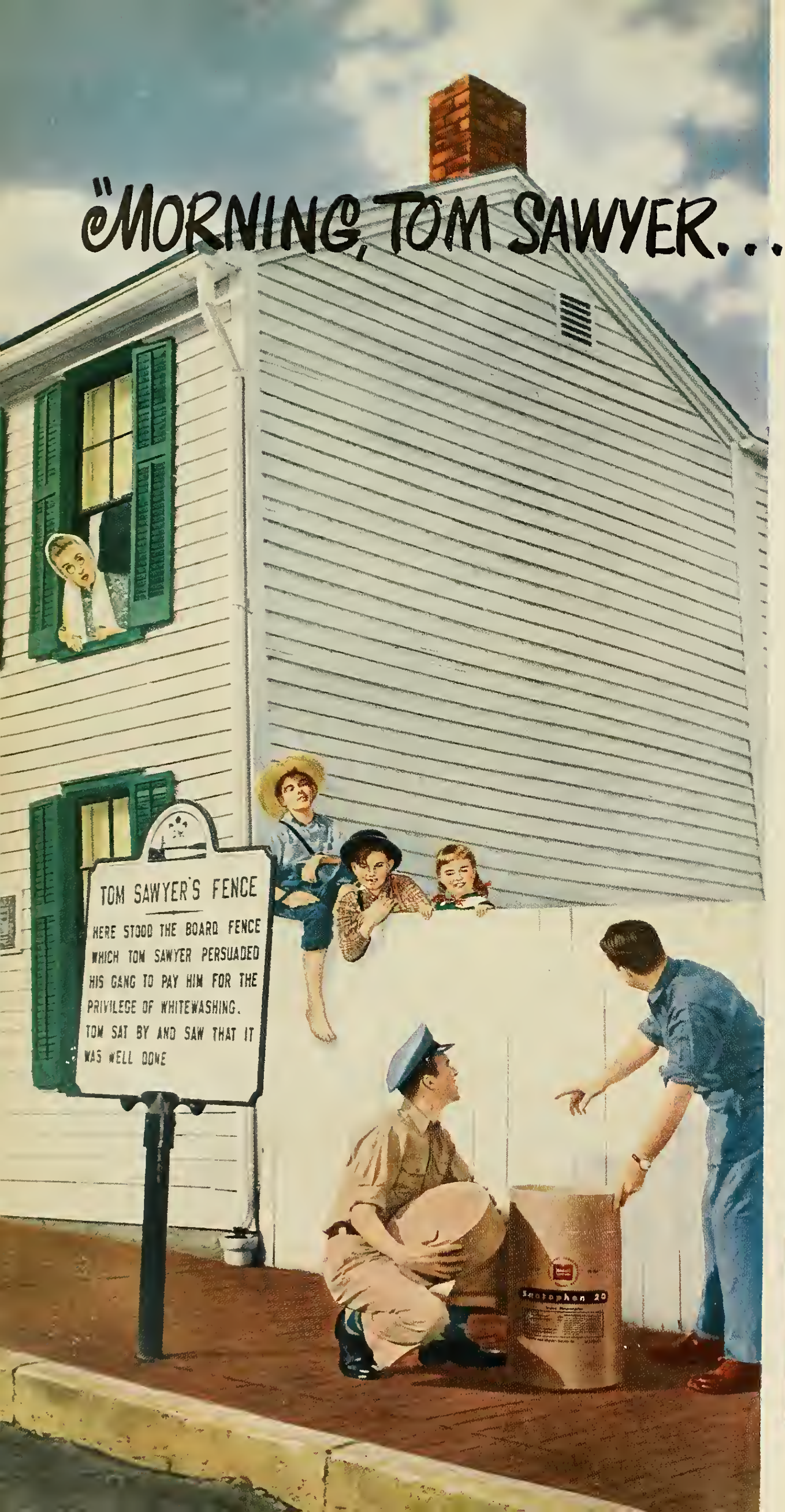
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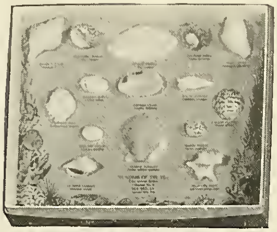
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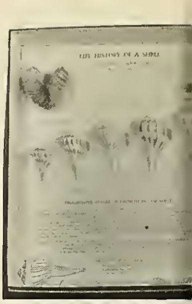
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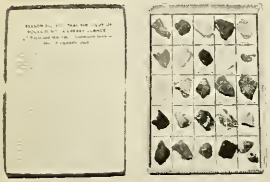

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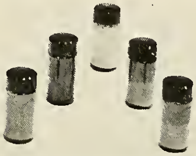

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LETTERS

Ice Age Fish in Arizona

SIRS:

As a traveler in the Southwest for more than 15 years who, like thousands of others has felt the fascination of the American deserts, may I compliment Lucile and Harold Weight on their absorbing account of Organ Pipe Cactus National Monument. . .

It may interest your readers to know that this Monument can boast of having one of the two remaining Arizona populations of a curious little fish that came down to us from the Ice Age, when this dry expanse was a better watered land. The fish evidently reached the little spring-fed pond at Quitobaquito from the Colorado River by way of the Río Sonoyta. At that time, the Sonoyta wandered over the arid sands to the Gulf of California, but since then its flow has diminished and it has been interrupted by a great lava field.

The little fish has a name, *Cyprinodon macularius,* almost as long as itself. The male attains a length of only about two inches. The female is slightly smaller on the average. In April, 1950, I saw the fish in courtship, the males flashing their most brilliant colors and standing guard over selected territories where egg laying was to take place.

A hundred years ago, this fish was still living in streams near Tucson and Benson, Arizona, but the advance of civilization has depleted these waters and caused its disappearance there. Except for the oasis at Quitobaquito, it survives only in one spring near the Santa Rita Mountains. Let us hope that a hundred years from now it will still be there, a scientific heritage of the past, to delight those who seek it out.

ROBERT R. MILLER
Associate Curator of Fishes
University of Michigan,
Ann Arbor, Mich.

Porpoise Age

SIRS:

Osmond P. Breland, in his very interesting article on the longevity of animals, expressed the hope that some ambitious person would corral a herd of whales and keep them under observation for many years in order to determine their life span. Although Mr. Breland was referring to the large whales, I'd like to point out that a herd of dolphins (commonly called porpoises), which are, of course, small toothed whales, has been corralled and is being kept under observation in one of the giant tanks here at Marine Studios. Four of our bottle-nosed dolphins *(Tursiops truncatus)* were born in this tank and now range in age from two to five years.

Even less is known about the life expectancy of these porpoises than about that of the great whales. The only published figure I know of goes all the way back to Aristotle, who wrote, "Dolphins (probably the common dolphin *Delphinus delphis*) are known to have lived for 30 years; the fact is, fishermen nick their tails sometimes and set them adrift again, and by this expedient their ages are ascertained." We do not yet know how accurate this figure is, but there is reason to think it may well prove to be close to correct. . .

F. G. WOOD, JR.
Curator
Marine Studios,
Marineland, Fla.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on these pages will be paid for at $3.00 each, with full credit to the photographer. Return postage must be included.

Has Anaconda Entered Florida?

SIRS:

It was stated in the press some time ago that the anaconda had become established in a swamp near Jacksonville, Florida. Is this true?

A. W. WICKHAM
Tryon, N.C.

Answer:

I have not heard of this report, which is almost certainly erroneous. No exotic snake is known to have become established in the United States, although several lizards have.

C. M. BOGERT
Curator, Department of
Amphibians and Reptiles
American Museum of Natural History
New York, N. Y.

Our National Forests

Readers of NATURAL HISTORY Magazine are still writing letters expressing their reactions to the article "Cut or Let Grow" in the February issue. The voting remains approximately the same: 97% in favor of cutting less timber on National Forest lands, 3% in favor of cutting the same amount or more. Space permits only the publication of these excerpts:

SIRS:

. . . I would endeavor to point out that, although knowing little of the Forest Service's administration, their long range policies seem to be in accord with the best interests of our woodlands.

To begin with, the concept that a forest should be blocked off from inroads of industrial man is erroneous. . . The management of woodlands has a practical as well as an esthetic object. The "saving" of a forest tract is not the prohibiting of all cutting practices within it. Rather, it is a wise, conservative, and highly technical application of cuttings in order to harvest the mature and defective trees, and to provide for better future growth. . .

I would favor a more practical system of management in which most all the veteran trees are harvested as they reach maturity. . .

THOMAS M. ARMSTRONG
Durham, N.C.

SIRS:

. . . Your article "Cut or Let Grow" is timely, and I had the same reaction to Mr. Parkinson's explanations . . . as you expressed in your concluding paragraphs. The simple fact remains that we are steadily losing our timber resources . . . The pitifully small 2½% of the area of the United States still under virgin timber could not possibly give us any lasting financial benefit if it were all logged off now and finished. . . I think also there is no more fundamental problem before us than the whole question of conservation, not alone of forests, but all forms of national wealth.

And may I add one thing more? I believe that beyond the logical, scientific dollar-and-cent arguments for the forests, there is room to plead the case of sheer beauty. Beauty is its own excuse for being, and the esthetic and spiritual value of a virgin forest actually needs no apology for its continued existence.

ROBERT E. GREGG,
Assistant Professor of Biology
University of Colorado,
Boulder, Colo.

SIRS:

I was interested . . . particularly in the statement that "during the fiscal year of 1951, total timber cut on National Forests exceeded 4 billion board feet" and that "close to 6 billion board feet of timber could be cut each year without depleting the growing stock."

From the picture published on page 90, we are led to believe that red pine should be 125 years old for saw lumber. I think that most of the lumber is harvested from trees over 200 years old. Is it possible to continue cutting at the rate of six billion board feet per year and still have mature trees to cut 50 years hence? Will our stands of virgin-

Continued on page 239

Readers are reminded that separate reprints of the covers of NATURAL HISTORY are available for 5¢ each, plus 5¢ for postage and handling. Write to Man and Nature Publications, 79th St. and Central Park West, New York City, 24.

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NATURAL HISTORY

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THE COVER THIS MONTH

The picturesque mariposa lilies, or butterfly tulips, of western United States and Mexico number nearly 60 species. Some have nodding flowers; in others, however, the flowers are erect, and that is the case with the sego lily, *Calochortus nuttallii,* which we see pictured here.

The scientific name *Calochortus,* meaning "beautiful grass," is appropriate, for all the mariposas have long narrow leaves. The sego lily is the most widespread of all the species. The bulbs (Indian name "sego") were eaten by the Hopi and Navajo Indians, and even by the Mormon pioneers when food was scarce. *C. nuttallii* usually has white or purplish flowers, but in a limited area of northeastern Arizona and adjacent New Mexico and Utah one finds the beautiful yellow variety *aurea* shown in the photograph. In the background is a log of petrified wood, many millions of years old, which has now become a jewel-like mass of color. It was once a tree growing in a low, marshy valley, though now the Petrified Forest National Monument where it lies is arid.

Henry K. Svenson

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China to Chitral • Greenland's Birds
Exploration of Space • Desert Year

THE EXPLORATION OF SPACE

- - - - - - - - by Arthur C. Clarke

Temple Press Ltd., London
Harper and Bros., New York, $3.75
196 pp., 16 plates

THIS little volume, by the Chairman of the British Interplanetary Society, represents a worthy contribution to popular science in a field in which there is tremendous interest today. In words that everybody can understand, it answers scores of questions that occur to the average person regarding the present status and future possibility of travel to the moon, the planets, and even beyond the farthest outposts of the solar system.

It contains just enough descriptive astronomy to emphasize the scope of such an undertaking as space exploration and explains in vivid style the high lights of rocket research up to the present time. The principles of rocket propulsion are described in lucid, nontechnical terms without reference to mathematical formulas and other abstractions that so often frighten the layman. This description is accompanied by a few well-chosen line drawings that serve to illustrate the most important features under discussion.

Among other matters, the author briefly explains the problems of spaceship construction, navigation and communication in space, and the interesting subject of stations in space. Each of these subjects is covered in a separate chapter.

While some of the illustrative plates are more or less of the science-fiction variety, they do not seem too much out of place, since they represent the artist's intelligent guess regarding the shape of things to come in the world of tomorrow or the day after.

All in all, this book should prove of value to the reader who wishes to know just how far we have gone along the highway that leads to the Buck Rogers era.

While less complete and scholarly than Mr. Willy Ley's recent work, *Rockets, Missiles and Space Travel,* this book should prove interesting and informative to younger readers of high school level or those of more mature years who desire a quick résumé of the subject.

ROBERT R. COLES

CHINA TO CHITRAL

- - - - - - - - - - - by H. W. Tilman

Cambridge University Press, $4.75
124 pp., 69 photos, 4 maps

THIS book is recommended as excellent reading for anyone who likes to learn about travel in remote and backward places and who thrills to the scaling of mountain heights from the hazardous environment of an easy chair. Above all, this is a book for the reader who appreciates a keen, discerning wit and a subtle turn of phrase. The author has been places, he does things, and he knows how to write.

It is refreshing to note the absence of "adventure" so often the underlying theme in books dealing with this field of endeavor. Tilman undoubtedly encountered plenty of situations that could afford "adventure," but he adapts himself to conditions as he finds them. He has the competence to meet the unexpected and the disappointing, and the reader soon realizes the author is a true explorer.

The story tells of travel from Shanghai across China to Chitral in India. The means of transportation are various, the airplane, the motor car, the horse, and his own two feet. The age of technology is causing ripples on the backwaters left by a vanishing era. Tilman could not speak many of the languages current along such a lengthy itinerary, but he has a happy faculty of getting what he needs, nevertheless. Progress is leisurely at times, but the narrative does not drag. Something of interest happens continually.

As Tilman enters the western stretches of his long journey, he digresses on several occasions to attempt mountain climbing. Climatic conditions were against him, and the ascents were unsuccessful. He frankly admits failure,

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but the reader gets the impression that the author has all of the qualifications of a first-class mountaineer.

The book is splendidly illustrated by many very good photographs.

In the event that I have left doubts in the minds of anyone reading this review, I should state that I enjoyed reading *China to Chitral.*

Harold E. Anthony

THE BIRDS OF GREENLAND VOL. III

- - - - - - - - by Finn Salomonsen,
Drawings by Gitz-Johansen

Ejnar Munksgaard, Copenhagen, Denmark, $9.00, 260 pp., 16 illus.

THE final volume of this extraordinarily sumptuous book is the largest, running to 260 bilingual (Danish and English) pages, with 16 plates after Gitz-Johansen's water colors. It contains also a folded map of Greenland (23 x 16 inches), prepared by the author in conjunction with the Geodetic Institute. Pages 561-575 are devoted to a systematic list of the 224 forms of birds recorded from the great Arctic island. Many of these are, of course, only casual visitors, but the status of each has been substantiated by the capture of at least one specimen. Erroneous or doubtful records are discussed in footnotes, and the pertinent ornithological literature is cited. Incidentally, this list includes English as well as technical names, and Danish names of all birds that possess them. There are no Danish vernaculars for certain American species, such as the blackpoll warbler, which occasionally reach Greenland.

Another section is made up of comprehensive bibliography of nearly 600 titles. This is followed by an index of bird names—Latin, English, Danish, and Eskimo—a table of contents, a list of the 52 plates in the complete work, and a colophon.

Birds treated in the present part comprise seven members of the auk family, three hawks and eagles, two owls, and ten passerine forms (wheatear, fieldfare, pipits, wagtail, redpolls, buntings, and the raven). The biographical accounts are all interesting and informing. Some of them, such as that on the great auk, throw light on both the climatic and the human history of Greenland. Particularly noteworthy is Salomonsen's text on several of the more abundant high-arctic species, such as the dovekie, a sea fowl of "lovely twittering song" and of vast economic importance to the Eskimo. The dovekie nests in many colonies numbering five million pairs, and the flocks in air "resemble at a distance swarms of mosquitoes or drifting smoke." It is regrettable that space limitations forbid quotation of more of the author's concise yet colorful descriptions of the sea eagle, the gyrfalcon, or one of the songbirds such as wheatear or snow bunting.

As to the plates, the reviewer holds the high opinion expressed with reference to Volumes I and II of this book. They are not all of equal charm. It has become evident, too, that the majority of ornithologists view them with a jaundiced eye. Let it be repeated, therefore, that Mr. Gitz-Johansen is to be felicitated because of his bold brush, his pure color, his originality in design and in clean impressionism. He has shown wisdom in departing from the style of Audubon, a master who has thus far been followed slavishly but quite inadequately by the bulk of bird portrayers in both Europe and the New World.

R. C. Murphy

WILD WINGS

- - - - - - - - by Frank S. Stuart

McGraw-Hill Book Co., $3.50, 222 pp.

THIS book presents an unfortunate mixture of fact and fiction. Portions of it are quite authentic and could serve as a medium for introducing readers to interesting facts in the life history and activities of wild ducks, but the errors are too numerous to make such a recommendation possible. The text is pleasantly written, and this very fact makes the inaccuracies more plausible.

A catalogue of the misstatements would occupy more space than can be devoted to it, but a few examples may serve to indicate their nature. An albino mallard occupies a prominent place in a flock of pintails. The birds guide their migratory flight by the pattern of the stars, detect a coming change of wind by the altered wave pattern on the sea, and "sniff" an approaching storm. They "grow aware" of an island a hundred miles off course although none of them have ever

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seen it, having received knowledge about it from others that in turn inherited their knowledge. They smell the approach of an enemy; at times they even cease to "think." A female, whose nest was despoiled for building material by another duck, visits the robber's nest and takes back only her rightful pieces, but her mate in a rage demolishes the remainder.

To make matters worse, credit is given for help by unnamed members of a number of reputable scientific organizations, leaving the impression, probably unjustified, that they vouch for the basic accuracy of the account. In any case, the book is bad natural history.

John T. Zimmer

THE DESERT YEAR

- - - - - - by Joseph Wood Krutch

William Sloan Associates, $3.75, 270 pp.

MANY people think of a desert as a barren, lifeless, desolate area, something forbidding, possibly sinister, and normally to be avoided. Here, however, Mr. Krutch shows that the desert region of our Southwest is one of life and change and light and mood as much as in any other part of the country, but with a life and a mood and an annual cycle that is all its own. Most of us visit this desert country, if at all, for only a short time, and for only a part of a single season. Here it is shown that there are many seasons and that the elements that make them up, whether they be bats or toads or cactus or rains or sunrises or roadrunners, are all interesting and all worth knowing.

To a point of view like this, in which the changes of the seasons are described, almost poetically, and where the various aspects of desert life are watched, almost hungrily, there is brought a gentle and beautiful form of telling about it all that is satisfying. I feel, and any reader will feel, that Mr. Krutch knows a great deal about the natural history of the desert, but it is obvious that he knows it in the same way that any of us might know it—by observing closely, by thinking about what has been seen, and by inquiry about unknowns from sources of repute. Step by step he shows how humbleness in the face of ignorance and effort to learn may result in understanding. Any reader can feel that he knows more of the desert country of the Southwest through reading this book. Perhaps, more importantly, he will understand that there is much more to know and that a visit would be exciting and profitable.

Carl Russell

CRIP, COME HOME

- - - - - - - - - - by Ruth Thomas

Harper and Bros., $2.50, 175 pp.

THERE is a delicacy about this book, which makes it difficult to review. A story like this one involving the happiness of two people whose life together was known to be measured, could hardly be told without a tendency toward sentimentality. This tendency grows less obvious, however, as the story develops, so can, I think, be discounted.

This book is the story of ten years of study of a banded brown thrasher, which returned regularly each spring to the author's garden. It presents careful details of the bird's habits. This type of writing is of intense value in helping to spread among both amateurs and the initiate an appreciation of birds. The more such studies are made, the better for mankind as well as for the protection of the birds.

Observations are made on mating habits, the age of birds—especially of Crip—the songs of various birds in different seasons and circumstances, numbers of broods, frequency of accidents, nest building, feeding, the life of the garden. Mrs. Thomas explains the methods she used in banding birds, such as right or left leg or green or red bands. This made it possible for the Thomases to follow the habits of individual birds, including Crip's mates.

The fact that Crip and his friends not only came back to the Thomases' garden year after year, but also always made a beeline for her peanuts, explains her idea that Crip and other birds could show the "hard, clear gleam of a mind." A bit of anthropomorphism is not out of place!

Underlying the bird's story is the human tragedy of her husband's (Stan) long, last illness: "All our yesterday's were gone, and we had no future. Each day was the whole of life." It is the height of maturity that these two people could fill such days with the best of constructive living.

Grace E. Barstow Murphy

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The Grea

AFTER following a trail of beer cans from home to a National Park or Forest, the optimistic tourist somehow hopes that the ugly trail will end abruptly. But he is in for a big jolt. For however schizophrenic the American public is in other aspects of life, it is painstakingly consistent in this one. It continues its careless habits right into the heart of America's most superb scenery. And its slovenliness is the hobgoblin of underfinanced and overburdened Park and Forest officials.

While nature-loving Americans are concerned over the flooding of the spectacular Dinosaur National Monument and other scenic areas with dams proposed by the Bureau of Reclamation, all of our National Parks, Monuments, and Forests are being inundated by a steady flood of waste paper, pop bottles, and garbage. Come hell or high water, this man-made deluge disfigures these priceless areas at an alarming rate. With 65 million persons passing through the portals of our Parks and Forests each year, the situation becomes critical.

And the very person who exclaims, "How disgusting!" at the sight of a hideous heap of roadside rubbish may throw a cigarette butt or candy wrapper out of the window as he rounds the next bend in the road. As a woman in East Tennessee used to say with sublime understatement, "Ah *ne*-vah thought!" It is just this thoughtlessness that causes our nation's highways and byways—and even choice recreation areas—to become monuments to the Great American Litterbug.

The millions of Americans who oh'd and ah'd at our natural wonders and historic sights succeeded in doing six million dollars worth of damage in 1950 in City, County, State, and National Parks alone in terms of stolen and mutilated facilities, defaced trees, rocks, and monuments, and the dumping of trash.

Park and Forest officials hasten to reassure us that 90 per cent behave perfectly—that only ten per cent commit the serious vandalism. But ten per cent equals six and a half million visitors, and they can do a *lot* of damage.

With mounting numbers of vacationists visiting our National Parks and Forests each year, the guardian angels of these areas are bewildered. The gap between visitor-cost and the necessary financial wherewithal reminds us of the chasm between the North and South Rims of the Grand Canyon. The Park and Forest Services have been forced to operate on such a petty-cash basis that they have been called the financial stepchildren of the Government. Ironically, they are probably John Q. Citizen's favorite offspring.

The purpose of this article is not so much to decry the woefully inadequate funds of the Park and Forest Services as to describe some of the deliberate vandalism inflicted on our nation's most prized natural and historic areas and to point out the true consequences of the seemingly harmless habits of which most tourists are guilty. If we realized that these great national playgrounds and outdoor museums are, in reality, our own

Our natural wonders rival those of any other land, but we desecrate the irreplaceable works of nature with rubbish and defacement. Are *you* a vandal?

American Litterbug

By Annette H. Richards

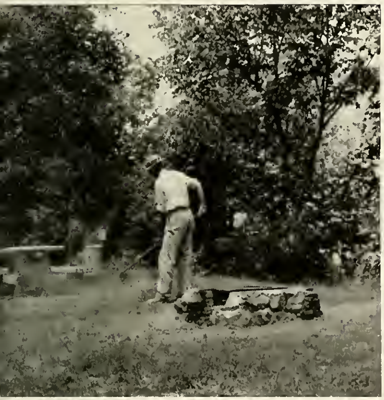
property, we might begin to feel a personal sense of responsibility for their welfare.

In extreme cases, vandalism destroys the very sort of natural phenomenon for whose preservation the Park is actually created. For man cannot refashion with his own hands something it took millenniums of sun, wind, water, and sand to create. Once destroyed, it is lost forever.

Take the case of a unique sand-

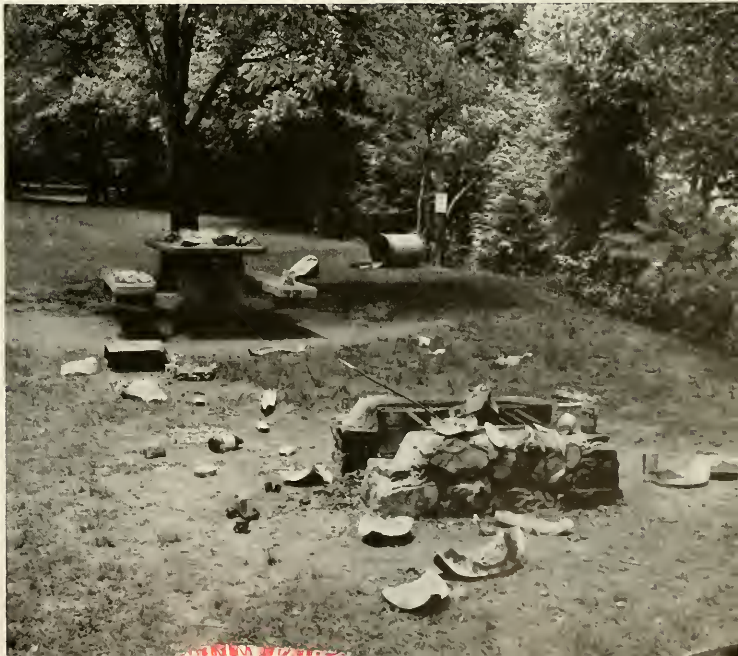
U. S. Forest Service photo

▲ Parks and Forests provide beautiful spots for picnicking. Let's keep them beautiful. Remember the next fellow



Forest rangers clean up picnic areas efore visitors arrive. This scene in 'isgah National Forest in North Caroina is typical of the pre-weekend cleanup

U. S. Forest Service photo



The same picnic site a few hours ter. It is littered with everything from vatermelon rinds to half-eaten sandviches, broken pop bottles, lunch papers, artons, and tin cans

U. S. Forest Service photos

◂ **For people** who like to get away from it all and camp out, the National Forests offer a wide range of wild and beautiful country. But. . .

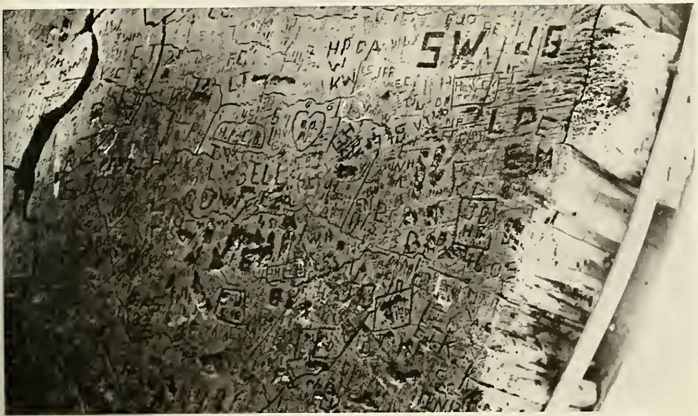
▾ **One discarded** can attracts anoth This dumping ground on the Shasta N tional Forest in California was started one careless person. Soon the beautif forest had been converted into an eyesc

▾ **Thoughtless** picnickers removed the shingles from this shelter in the Pisgah National Forest in North Carolina and burnt them for firewood. Note also the initials

stone formation in southern Utah known as the "Goblet of Venus." For years, travelers on their way to Natural Bridges National Monument would stop at sight of a sign pointing to this natural wonder. Intrigued by its unusual name, they would stop their cars and walk a few hundred feet to satisfy their curiosity. What they found was a never-to-be-forgotten spectacle. The five-ton weight of this huge umbrella-shaped monolith, twice as tall as a man and about six feet across the flat top, was supported by an unbelievably delicate base that was barely a foot in diameter. Standing as though in defiance of the laws of gravity, the Goblet of Venus was as a tribute to Nature's amazing handiwork. But if you did not travel over that out-of-the-way road before June 17, 1948, you are among the unfortunate ones who will never see the Goblet of Venus. For this irreplaceable monument, which may well have been the only one of its kind, fell prey to a destructive vandal who, not content to observe and enjoy, ruthlessly knocked it down.

Consider, too, the fate of the Stone Face in the Shawnee National Forest in Illinois. It received the rock-throwing treatment. Self-styled heroes laid siege and bombarded it with rocks, so that at this stage of the one-sided battle, the chin has succumbed and fallen off. If the attack persists, there will soon be no recognizable stone face, and future visitors will wonder where the recreation area got its name.

Vandals go underground as well. A visitor to Valentine Cave in Lava Beds National Monument between clean-ups in 1948 would have been rudely disappointed. For as he entered its welcome shade and coolness, he would have been overwhelmed by a nauseating stench of rancid mustard, sour catchup, and decomposing garbage. His feet would have crunched noisily on thousands of fragments of broken



▲ **The surface** of this Redwood section was badly scarred by initial carvers at Sequoia National Park during the war. This type of vandalism gets out of control when there is not adequate personnel to protect the Park. Better woodland manners would mean lower taxes and better outdoor facilities

National Park Service photos

▲ **The Goblet of Venus**, before a vandal knocked it down in 1948. Its creation required thousands of years. Its replacement: impossible

▼ **A would-be** marksman not only made this list of "National Forest Camp Rules" illegible; he also injured the tree

U. S. Forest Service photo

glass, and his eyes would have been assaulted by hideously disfigured walls and floor. Close by in the lovely Crystal Ice Cave, our modern cave men had really gone to town. Here they broke off and smashed a good portion of the exquisitely formed ice stalactites and stalagmites ranging in length from eleven to fourteen feet.

In this same Monument, ancient people laboriously carved designs with crude implements along the face of a sheer cliff, which also provides refuge for a hawk and owl population. As in all National Parks, the wildlife is protected from hunting and trapping. Nature and the Park Service have been meticulous in preserving these ancient petroglyphs and their present winged neighbors. But hunters have not been so considerate.

With superb disregard for the historic and artistic value of these creative expressions of prehistoric people and in outright defiance of No Hunting regulations, hunters have fired away ruthlessly with both shotguns and rifles. Unless something drastic is done to stop the vandalism, both the petroglyphs and the hawks and owls will disappear forever from the escarpment.

But let's go on an average family outing and see what could happen. Looking forward to picnicking by a crystal-clear mountain lake, we are full of anticipation at the prospect of enjoying the beauty and quiet of the great out-of-doors, unspoiled by the desecration of man. Before we reach our destination, we may miss a few turns because directional signs have been tampered with or stolen. But we take it in our stride and finally arrive, though later than we had planned. We all pile excitedly out of the car. While Mother starts to get out the food, Dad hunts for firewood and water, and the children make a beeline for their promised swim.

But what does Mother find when she looks for the picnic table? It may be broken to pieces or have a hole burned in the middle from being turned upside down on a campfire. It may have been chopped up for firewood, have broken glass pounded into its surface, have been stolen *in toto*, or be floating somewhere out on the lake. If it actually is there in one piece, it may at least be rough with initial carving or littered with rotten fish heads, fly-laden watermelon rind, and assorted decaying garbage. Far-fetched? Not at all!

Let us see how Dad is making out. Armed with his coffeepot, he has walked to the pump. Abruptly his cheery whistle ceases. What discovery has he made? He has found the pump handle broken, the trap door to the well pried open, and its depths filled with refuse. A little exaggerated? You haven't heard anything yet!

If his holiday spirit is still undaunted, he may proceed to the lake, deciding in his sensible way that coffee water has to boil anyway. On reaching the water's edge, he finds that other visitors preferred polluting the clear, cool waters with their picnic debris rather than placing it in the handy garbage cans. By now he may be starting to use some unprintable language.

Meanwhile, Junior and the girls have rushed to the toilets to change into their bathing suits. With fingers tightly clamped over their noses, they report to Mother that it is "dreadful in there!"—all messed up, full of flies, and with the screens torn off. As they race off, Dad shouts after them, "Be careful, kids, the life rings are gone. Stay in the shallow water." (People have lost their lives in National Forest lakes because of stolen life rings.)

Mother and Dad try to make the best of a bad situation and are relieved to hear the children splashing happily in the lake. Dad prepares to build a fire but finds the fireplace grates stolen, bent, or broken, the chimney jammed with rocks.

Suddenly a sharp cry pierces the forest. "Mother! Dad!"

Both parents drop everything and rush to see what has happened to Junior. With tear-stained face, he limps painfully from the water.

"I stepped on a broken bottle," stammers Junior bravely as he holds up a bloody foot. (Vacationists have been known to be laid up for an entire summer with cuts inflicted by broken glass in National Forest lakes.)

To bring this sad summer saga to a miserable end, let us say that it starts to pour. Everyone scrambles to the shelter, Dad carrying the injured Junior. What is the last straw? The roof leaks like a sieve, because vandals have torn off the shingles for firewood. And the floor, tables, and benches would make a pigpen resemble an immaculate New England parlor in comparison.

It is a disillusioned and unhappy family that returns to Centerville that night. A pleasant holiday has turned into a near calamity. Bedraggled, hungry, and injured, they wonder how that lovely picnic ground ever got that way.

Had they suffered mere inconvenience and disgust at the state of the facilities, it would be bad enough, but a far deeper interest than physical comfort motivates most people who sojourn in these spots. They come for inspiration, for renewed contact with Nature at her grandest and most spectacular, for restored perspective. They vaguely yearn for intimate experience with the grass roots, far from our highly urbanized and standardized civilization. They seek not only to worship the awesome wonders at a respectful distance but to enjoy the manifestations of Nature that are close at hand—the trees, shrubs, and wildflowers.

In a setting that should be sublime, the visitor recoils and recalls that "only man is vile." Broken fern fronds in Hawaii, hacked cactus plants in El Morro, 20 to 30 daily flower-picking violations in the Great Smoky Mountains, peeled birch bark in Wisconsin, and a spike driven into the lone Jeffrey Pine on top of Sentinel Dome in Yosemite—all of this adds up to downright destructiveness. Mother Nature cannot repair it for many years.

In the fall, tourists travel for miles to see the beautiful aspen trees in the higher altitude areas like the Grand Teton National Park. Their trunks and their rustling golden leaves against the rich green of the pines and firs are a delight to all who pass. But would-be inscribers of immortal "John Henry's" seem unable to resist the temptation to carve their names into the vulnerable white bark. These black open wounds not only ruin the beauty of one of the loveliest trees to be found anywhere on the continent but eventually may cause their death. And so it goes. . .

Behind the need for recreation lies the still more basic function of watershed protection. Anyone who has lived through shaveless Thursdays in New York can tell you that. The conservation and regulation of the water supply at its source is dependent upon a green mountaintop. By absorbing the rainfall, it effects a balance between flood and drought for the valley below.

In this age of jeeps and command cars, regions previously safe have no protection. On the Sandia Division of the Cibola National Forest in New Mexico alone, vandals carry off an estimated truckload of topsoil a day, leaving behind 365 denuded areas every year on which all vegetation has been killed. In this same Forest, fishermen dug up the wet meadows for angleworms and sold them in nearby Albuquerque. The rain washed the unprotected black topsoil down the mountain, leaving an ugly gash that may not heal.

This Forest is an exception to most National Forests in that a full 60 per cent of the work is devoted to public recreation. Nevertheless, there is only one patrolman available to cover thirteen public campgrounds with 5000 visitors on a typical summer week end. Manpower shortage, like death and taxes, is always with the Park and Forest Services. But considering this serious handicap, they are doing a remarkable job at curbing vandalism. Their bag of tricks includes as many methods as there are vandals. For vandals are an ingenious bunch, and in order to combat them, an even greater ingenuity is essential.

Publicity is a powerful weapon. The dreaded forest fire, which is caused nine times out of ten by human carelessness, receives prominent nationwide publicity. Who has not seen the Smokey Bear

WHITTLING
IF YOU
WHITTLE HERE

U. S. Forest Service photo

▲ LIKE something placed in the living room so a cat won't sharpen its claws on the furniture, this "whittling block" helps curb penknife vandals to some extent in Pike National Forest in Colorado

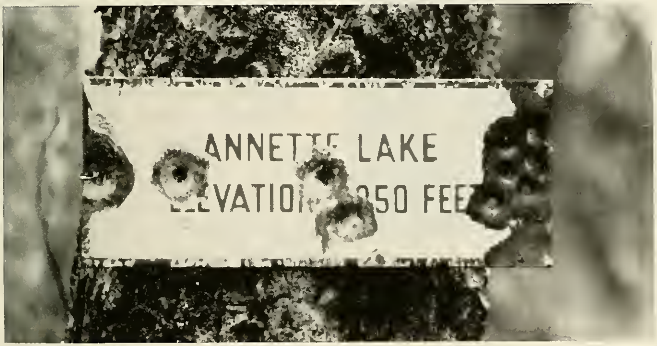


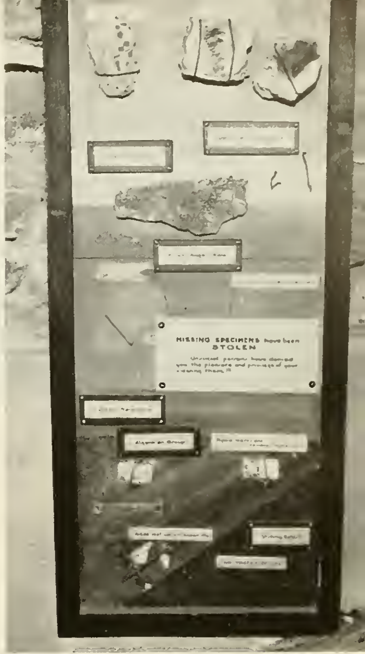
Photo by U. S. Forest Service

▲ THE ELEVATION of this lake in a Washington Forest remains a mystery to everyone, because someone riddled the sign with bullet holes

National Park Service photo

◀ THIS CANNON and carriage were stolen from Gettysburg National Military Park. It was found broken on the Gettysburg College campus

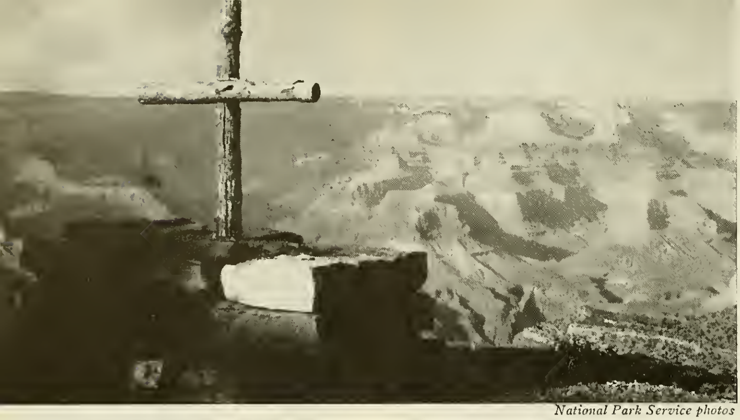
▶ THIS BOY and his companion were caught after they cut loose with a souvenir Japanese sword in the Cibola National Forest. They chose to mend damaged tables in preference to juvenile court



National Park Service photo

▲ SEVERAL specimens were stolen from this geological exhibit at Yavapai Observation Station on the South Rim of Grand Canyon in 1947. The vandals broke the glass in order to take the specimens. Other visitors can no longer see the full display

U. S. Forest Service photo



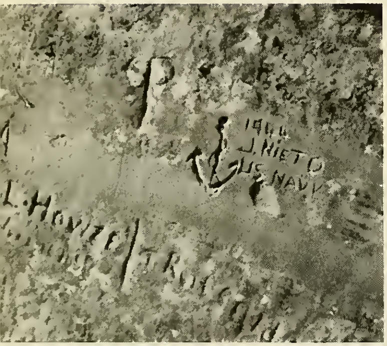
National Park Service photos

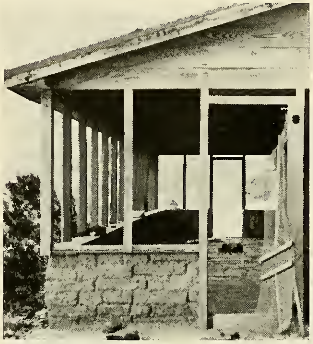
▲ **The "Shrine of the Ages"** on the South Rim of the Grand Canyon had to be replaced after vandals destroyed it. Easter sunrise services are held at this superb spot every year

Photo by Annette H. Richards

▲ **This solidly** constructed shelter on Sandia Crest in New Mexico no longer provides protection on a cold day. Vandals persisted in breaking its windows and doors and even jamming its chimney with rocks so that forest officials discontinued replacing the damaged materials

▼ **A Representative** of the U. S. Navy added his name to the historic inscriptions at El Morro National Monument. This kind of thoughtless vandalism costs rangers headaches and taxpayers money





▲ **A house vandalized** in Big Bend National Park. Note the broken screen door and the missing screens on the porch

posters, carcards, and stickers—Smokey, the bear cub with the charred paws, who survived the 10 million-board-foot fire on the Lincoln National Forest in New Mexico last May. Smokey has become the symbol of the plight of fire-trapped wildlife. For although enough lumber was lost by fire last year to build 30,000 homes, people respond more actively to the mute appeal of an orphaned, frightened bear cub. And perhaps in the future, they will be more careful about throwing matches, cigarettes, and cigars from moving cars and leaving untended campfires. Let us also hope that idle marksmen will no longer shoot at emergency firefighting equipment, glass telephone wire insulators, and occupied fire lookout towers. Yes, not only are communication lines and fire-fighting equipment at stake, but the very lives of towermen are jeopardized by the trigger-happy "sport."

Other types of vandalism are highlighted in local papers whenever possible—a mountain sheep killed in New Mexico out of season; a ski shelter in Wisconsin with smashed windows, broken frames, butchered tables, and scattered chicken feathers; a summer home burned to the ground in Washington. The Forest Service in particular is doing a fine publicity job in bringing these outrages to the attention of the public through the press.

Sometimes offenders are given a chance to repair their damage as an alternative to legal action. Mending the damage done by a souvenir Japanese sword may not be a teen-ager's favorite spare-time activity, but it is far preferable to juvenile court. Or at least so thought two New Mexican boys recently. And they will probably not repeat the performance either.

When a man pays admission, he seems to treat a place with more respect. At least this has been the experience of the Forest Service since 1949. The Forest Service only recently inaugurated this policy in 50 of the larger recreational areas. And in Oak Creek Canyon on the Coconino National Forest in Arizona, the experiment has worked. Vandalism has disappeared almost entirely.

The Parks have an over-all "interpretive program" which lays a solid groundwork for appreciation of Park phenomena. You meet this the minute you enter the Park. A courteous ranger in forest-green uniform greets you with an illustrated brochure that gives you the history, high lights, facilities, map, rules, etc. of the Park. A rustic, hand-carved sign informs you that "It is unlawful to mark, deface, or damage any historic or prehistoric structure, to injure trees, shrubs, and vegetation, or to carry away souvenirs." After you are settled in your cabin or camp site, you visit the museum or library and take a tour by foot, horseback, or car. That night you attend a campfire lecture, complete with singing, colored slides, and explanations of the archaeology, geology, or ethnology of the Park. After a day of this, most visitors have acquired some respect for their surroundings.

Although the entire Park is a huge outdoor exhibit in itself, the visitor learns to enjoy it even more through the graphic displays in museum and trailside exhibits. With their help, he strikes up a passing acquaintance with glacial action, primitive peoples, the redwood tree's secret of longevity, a variety of wildflowers, cavern formations, and American history. But even this key part of the interpretive program is subject to severe vandalism. Exhibits in the Colonial National Historical Park show a 300 per cent increase in vandalism in the past 3 years, a jump from $81 in 1948 to $235 in 1950. A redwood section in the Sequoia National Park was so carved up with initials during the war that it was impossible to count the annual growth rings.

The Grand Canyon's vast chasm attracts the world's great and not so great. The mighty Colorado River took countless millenniums to cut through the earth and lay open to view the innumerable colorful layers of rock and soil representing three of the five major chapters of the earth's geological history. The Park Service provides high-power binoculars for viewing some of the more noteworthy strata. But vandals steal these with disgraceful frequency, despite their being bolted down firmly. The interesting geological exhibit at the Yavapai Observation Station on the South Rim was broken into in 1947, and several specimens were stolen.

The Park Service has had to resort more and more to guided tours to keep vandalism in check. In this way, appreciation can be instilled, supervision can be maintained, and incipient vandalism can be stopped simultaneously. Carlsbad Caverns, for instance, reports practically no serious vandalism. But because of the size of its groups, it regrets the necessary regimentation and the drain on the interpretive program's effectiveness. Even in guided tours, however, the ranger cannot control all destructiveness. Last summer, a teen-age boy on a tour through the Casa Grande National Monument in Arizona, suddenly decided to try to climb the four-story mud wall with his bare hands. Before the ranger could do anything about it, he had knocked off a substantial chunk of this irreplaceable prehistoric structure.

Texas is a mighty big state—ask any Texan. But even Texas would be outranked in total area by our 328 National Parks and Forests. King-sized recreation grounds, and a king-sized population that needs breathing space in which to recreate body and soul. But despite the size of these areas, they are overcrowded. If you doubt it, visit Yosemite on a Fourth of July week end.

Unlike women and streetcars, there won't be another National Park or Forest along in the next minute. No, America's natural resources, even recreationwise, are definitely limited. There is only one El Capitan, one Old Faithful, one Grand Canyon, one Mesa Verde, one Mount Rainier. And unless we realize this, our children will inherit far less than we fell heir to.

The "There's more where this came from" attitude, combined with the souvenir-collecting mania, leads to major inroads on our Parks and Forests. Bred from a tradition of boundless and apparently inexhaustible natural wealth, Americans will be hard to cure of the "take it home" habit. The Indiana family that boasted of "outwitting" the rangers in the Petrified National Monument by smuggling out a huge specimen of petrified wood under the hood of their car might well pause to consider their action. If this type of insidious vandalism keeps up, it will not take long for this 160-million-year-old collection of rainbow-colored stone to disappear entirely, despite being the largest known concentration in the world.

The souvenir mania afflicts all ages and classes. A woman in the party of a United States Senator walked off with a prized book from the George Washington Birthplace National Monument after being shown the special courtesy of a personally-conducted tour behind the protective ropes.

College undergraduate prestige seems to go up when dormitory walls are adorned not just with ordinary "Men Working" and "Detour" signs but with handcarved trophies from our National Parks and Forests. Signs from Yosemite and Shenandoah National Parks and New England National Forests may add atmosphere to a student's room, but they also add $5 to $60 to the taxpayer's bill. When "Icy" signs are stolen from winter roads, even human life is endangered.

Strong-backed kleptomaniacs have managed to sneak 50-pound cannon balls past entrance guards in the Castillo de San Marcos National Monument. But the return of a huge brass nut, stolen from an old tide gate in the 1930's, demonstrates the slow but sure working of the Park interpretive program. Ten years after it disappeared, the nut came back in the morning mail, with an apologetic note from a New England

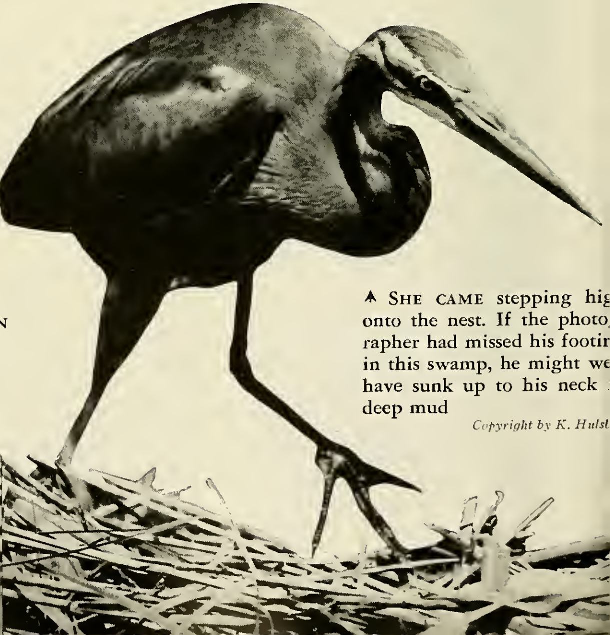
Continued on page 231

a camera hunt for the Purp

FROM an ornithological point of view, Holland enjoys in many respects a privileged position in Western Europe. For instance, it is the most northern and western nesting place of one of the rarest birds in this section of the continent—the Purple Heron (*Ardea purpurea purpurea* L.). A resident of marshes and swamps, this unusual bird breeds neither in Scandinavia, Belgium, nor England. The nearest other nesting sites are at least 500 miles from Holland, in the south of France, in the Neusiedlersee in Austria, and in the marshes of Balaton in Hungary.

The number of Purple Herons

▲ THE PURPLE HERON in a position of alarm



▲ SHE CAME stepping hig onto the nest. If the photo rapher had missed his footir in this swamp, he might we have sunk up to his neck deep mud

Copyright by K. Hulst

breeding in Holland is not very great. A colony of about 125 pairs finds a safe and quiet nesting place in a sanctuary called Naardermeer, in the heart of Holland. Here, strictly guarded, the birds have all the protection necessary for the colony to maintain itself. Outside this sanctuary, a few other small groups have their nests scattered over Holland. Although collecting eggs and trapping and killing these birds is prohibited and punishable by law, these unprotected colonies have suffered from illicit egg-collecting and from unscrupulous people who know that the young bring a good price abroad. As a result, it was thought at one time that these little scattered colonies would be lost, but thanks to better police supervision, we can at present report even a slight increase in their numbers.

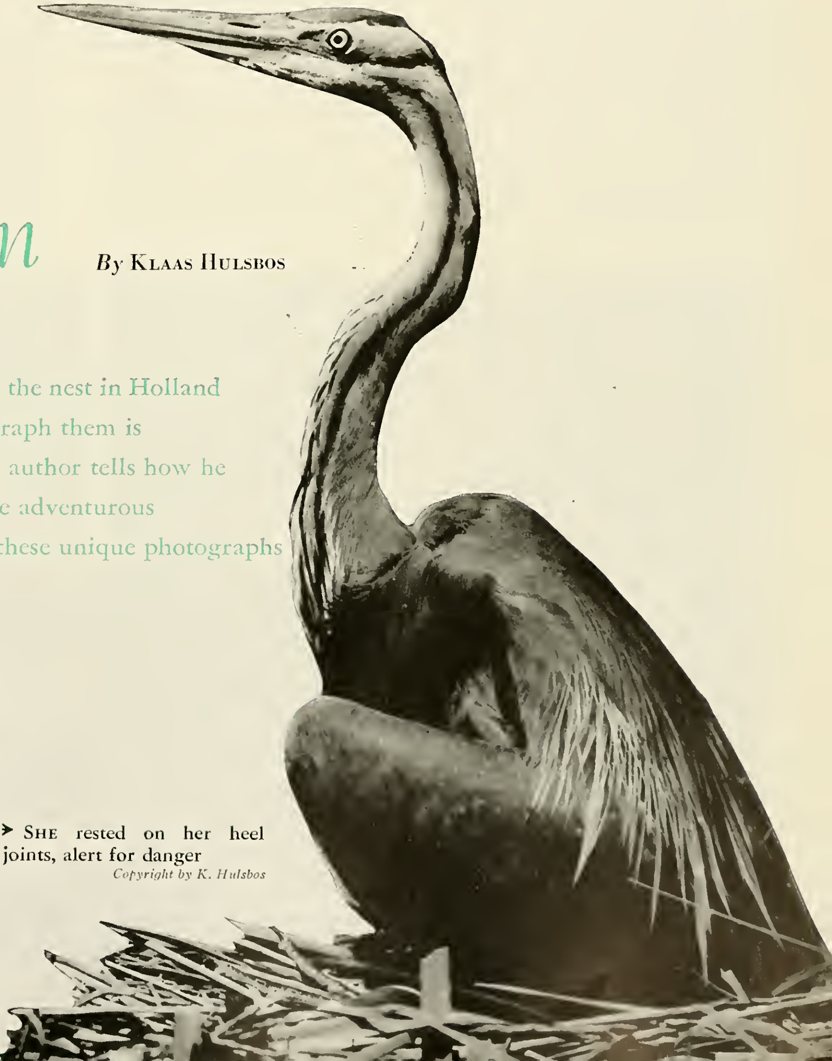
After being banded to determine their route of flight, only about 40 Purple Herons have ever been picked up. Their route indicates that the bird flies principally in a southwesterly direction to Africa (some reports have been received from Algiers and Senegal) and returns to Holland at the end of March or early April.

Exact studies have not yet been made regarding the way in which the pairs are formed, but it is known that they follow, in many respects, the same behavior as the Common or Gray Heron of Europe. The male Purple Heron, which arrives first at the nesting place, takes possession of an old nest or a suitable place in which to build a new one. Unlike the Gray Herons, which usually nest in colonies in the tops of trees, the Purple Herons ordinarily breed on the ground, sometimes in shrubs ten to fourteen feet high and always in the heart of extensive marshes and swamps, in spots practically inaccessible to man. When the female arrives later, the pairs are formed during

Heron

By Klaas Hulsbos

To find these rare birds at the nest in Holland is not easy, and to photograph them is all the more difficult. The author tells how he solved his problems on the adventurous journey that yielded him these unique photographs



➤ She rested on her heel joints, alert for danger

Copyright by K. Hulsbos

many interesting courtship displays. After a short interval, the pale greenish-blue eggs, varying from three to six in number, are deposited in the nest, which is constructed of reeds, twigs, and some dead vegetation. During incubation, the beauty of these eggs is soon destroyed by deposits of excrement.

Like the Gray Heron, which is common throughout the year in Holland, the Purple Heron lives largely on fish and other aquatic creatures, which it catches by standing or walking slowly in the shallows and seizing the prey with a quick jab of its powerful bill.

As there were in existence only a few good photographs of this splendid, rare bird in its natural surroundings, we were anxious to make an attempt to get the Purple Heron before the lens. As no permits are given for photography in the Naardermeer reserve, we had to search for one of the few nests scattered over Holland. We combed many places which, in our opinion, offered promise of success, but in vain. Then, by a stroke of good fortune, we met a fisherman in the northern part of Overijssel Province who was able and willing to show us a small colony of about half a dozen pairs.

Our starting point was one of those out-of-the-way, picturesque little hamlets still to be found in that part of Holland, which are accessible only by foot, cycle, or in a small boat—hamlets where all traffic and transport is done by water and only narrow footpaths through the meadows connect one house with another. A journey for hours in a rowboat through a labyrinth of water and reed beds, among fascinating flowers, insects, and birds, brought us to the colony of the Purple Herons. As the nests could not be reached by boat, we donned waist-high rubber waders. The sodden marsh ground, nothing but a mat of vegetation floating on the water, sank beneath our feet, and the swamp water reached our knees at every step. After some time, we saw the Purple Herons take wing, uttering a harsh shriek.

The nests were situated in a dangerous part of the swamp where, if we missed our footing, we might well sink up to the neck in the deep mud. Five nests could be seen, three of which were inaccessible. The other two could be reached, but it seemed impossible to erect a blind in such a muddy place. We debated long, trying to concoct some scheme to outwit the Purple Heron. The result was a sort of mattress of reeds and twigs in the sticky, fathomless mud, which we hoped would be stable enough to support a man and a camera for some hours. On this submerged raft we erected a well-camouflaged blind, which we left unoccupied for a day in order that the birds might become accustomed to it.

There was not a breath of air stirring on that bright June day when I was placed in the blind by my friends. A stake of about 20 feet was pushed into the mud to serve as a wavering support from which I could operate my reflex camera. Standing up to my knees in the water and mud, I could just see, through a little peephole, the eggs in the well-hollowed center of the nest, and I could survey a part of the reed bed in which the other nests were located. It was by no means a comfortable situation, and I prayed that the raft would prove stable enough to support me for some hours.

My friends withdrew, with an arrangement not to return for three hours unless I should give a signal of distress by raising a pole to which my handkerchief was fastened.

The Purple Herons, which had vanished into the surrounding reed beds when we arrived, soon were circling overhead. The three inaccessible nests were occupied first; and after a quarter of an hour, a bird alighted on the fourth nest, which was close by but out of reach of my camera. Now I was waiting for the return of "my" bird! What a thrill there is in watching a rare bird for the first time! My heart was in my mouth, and I hardly dared to breathe.

Five minutes later there was a splashing beside the blind, which sounded as if a man were wading through the swamp. Carefully I peeped through a hole and after some searching saw the bird standing among the rushes. The buff-colored neck, beautifully harmonizing with the tones of the rushes, gave her perfect natural camouflage. After carefully looking about for some time and then slipping between reeds taller than herself, she stepped with great care onto the nest. I focused the camera during her approach and with a quickly muttered prayer ventured the first shot. As she showed not the slightest trace of suspicion or nervousness, I worked as quickly as possible to record these magnificent moments.

There stood the Purple Heron—

a big, fine bird. The light struck to brilliance the bluish-gray of the back, wet with dew from the rushes. The almost white but slightly buff-colored neck was beautiful, bringing out sharply the narrow black line down the front of her throat. The bill was mainly yellow but brownish on the bridge of the upper mandible. From the shoulders, loose silvery-gray plumes fell downward like fine fringes over back and side, and those on the base of the neck—black, gray, and reddish tinted—fell like a handsome apron down the breast. Truly it is hardly possible to describe the beauty of her colorful plumage, over the whole of which lay the reddish glow that gives the bird her common name. The graceful feet, with slender toes and nails, were striking. The crown and flattened crest were bluish-gray, which identified the bird as a female, for on the male these parts are black. The bird arranged the eggs into position and settled down comfortably to brood.

It was very trying to stand on the same spot and to sink continuously deeper and deeper into the sucking mud. I had trouble keeping the raft balanced. After a time, I tried to move my feet a little, but the resultant splashing and bubbling was too much for the Purple Heron, and she hastily rose to her feet and looked nervously around. Soon she settled down again, but her fear was a warning that unless my actions were noiseless she would take flight.

It was not long before she became distressed by the heat—as was I—and with open beak and vibrating throat she lay among the motionless rushes. After some time, she arose and spent considerable time preening. Like the other herons and bitterns, the Purple Heron has patches of powder-down on its breast, which it uses to clean the feathers by transferring it with the bill and rubbing it into the feathers during preening. As the temperature was undoubtedly very high in the nest, there was no need to keep the eggs constantly covered, so the bird rested on her heel joints and with drooping wings shielded the eggs from the heat of the sun. In this position, with her neck arched in a graceful S-curve, she was very lovely to behold.

The camera worked continuously, fortunately without disturbing her. Nevertheless, she was constantly on the alert. Once, a plateholder slipped from my fingers and with a plop sank down into the mud. Immediately she rose again. Fortunately, there was a new plate in my camera, and I was able to photograph her in a position of alarm—one of the finest shots I made.

Every moment I spent in that hide was sensational, but the frail platform would not stand my weight. Constantly the water rose above my waders, and my camera and hide sank slowly until I could no longer see the eggs in the nest. Finally, it became impossible to work the camera because of intervening stalks and blades of

Continued on page 240

▲ SHE WAS a fine looking bird as she sat on the eggs, brilliant bluish-gray on the back

THE BIRD YAWNED with drooping wings, l from the shoulders, loose silvery-gray mes fell downward like fine fringes. . .

A MONTH LATER, high water in the rsh prevented picture-taking at the nest. wever, study of the young through field sses proved that, except for their color-, they bore a striking resemblance to Blue Heron, shown here

Copyright by K. Hulsbos

"When it's Springtime in the Rockies..

In the uplands of the Rocky Mountains,
spring comes later but more suddenly
and fills the air with sounds and scents
unknown to lowland dwellers

⮝ MELTING SNOW releases the tumbling waters of a thousand brooks, and beneath the softening blanket, myriad forms of life are making ready to greet the warmer season

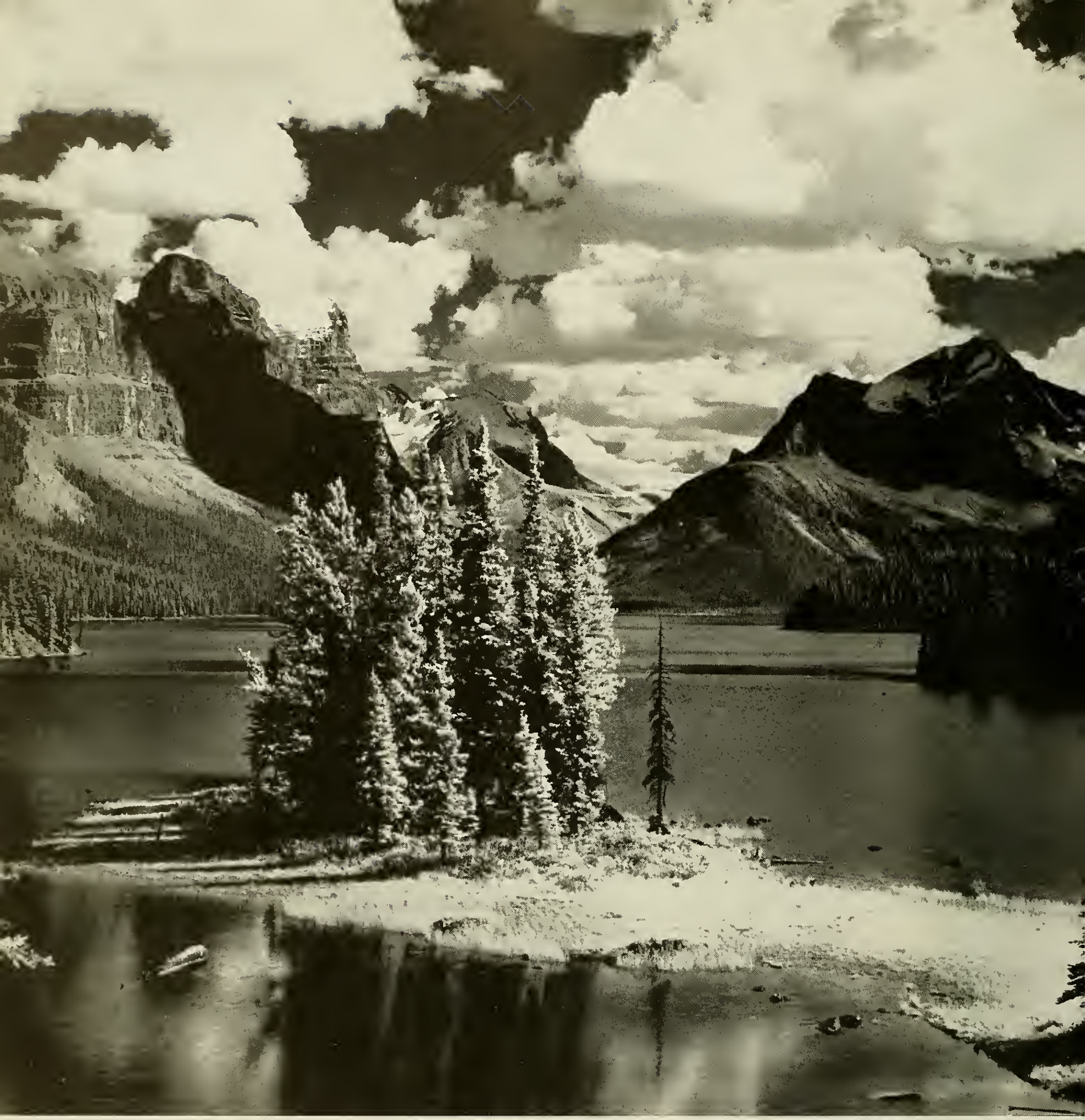
Karl King Krogue photo from Don Knight

⮜ WREATHS OF CLOUDS are the magician's cloak beneath which seasonal sorcery is wrought in the higher crags, which are never far from winter's grip. But anywhere below the tree line, spring conquers every wind-swept slope and is unchallenged in its warmth and brilliance

⮞ LOFTY MONARCHS li
Mt. Moran (12,594 fee
in Grand Teton Nation
Park, can receive a siftin
of snow when the verda
valley below is burstin
with life. Its summit is a
ways wintry, and its upp
slopes are only brushe
lightly with the wings
spring

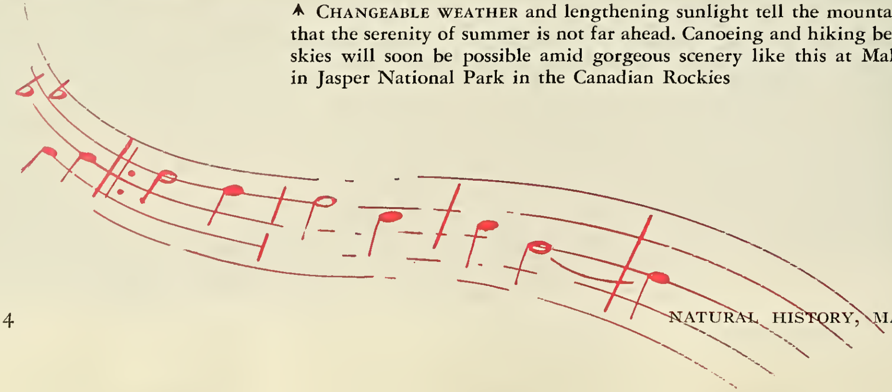
Ralph Anderson photo from Don Knig

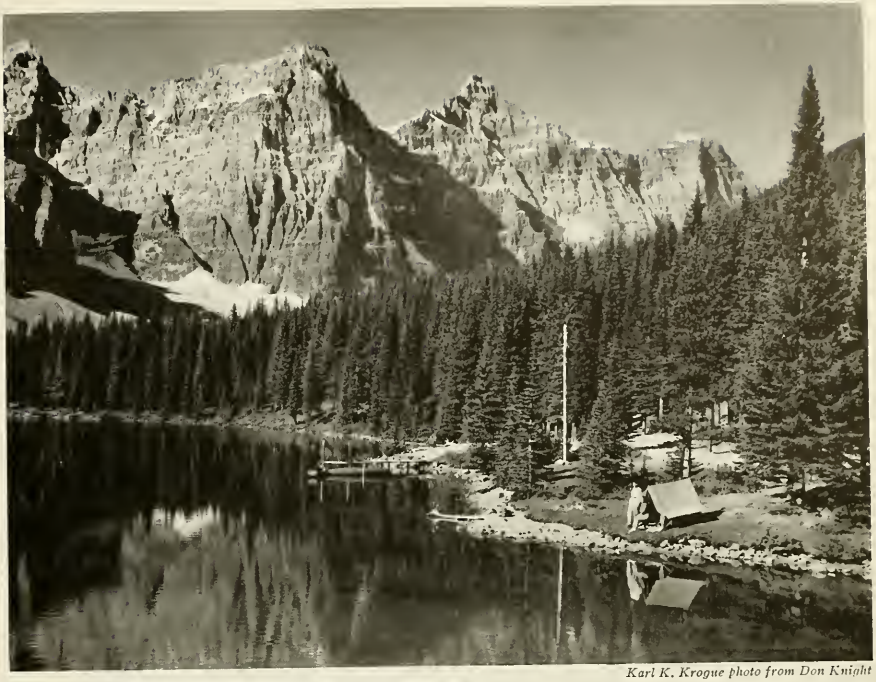
"WHEN IT'S SPRINGTIME IN THE ROCKIES . . ."



Bob Bishop photo from Don Knight

▲ Changeable weather and lengthening sunlight tell the mountain traveler that the serenity of summer is not far ahead. Canoeing and hiking beneath blue skies will soon be possible amid gorgeous scenery like this at Maligne Lake in Jasper National Park in the Canadian Rockies





Karl K. Krogue photo from Don Knight

▲ THOUGH SNOW FIELDS lie not far away, these campers in Canada's Banff National Park are soaking in the warmth of a sun whose health-giving rays are undiminished in the rare atmosphere of this elevation. The scene is on Moraine Lake, in the Valley of the Ten Peaks

➤ AS INCREASING warmth and forage herald the full growth of the summer season, wildlife in many forms gains strength for the rigors of the winter. Nature lovers everywhere plan outwardly for the harsher tasks of autumn and winter, but inwardly they yearn for the manifold beauties of the season of rebirth and count the months ". . . till springtime comes again"

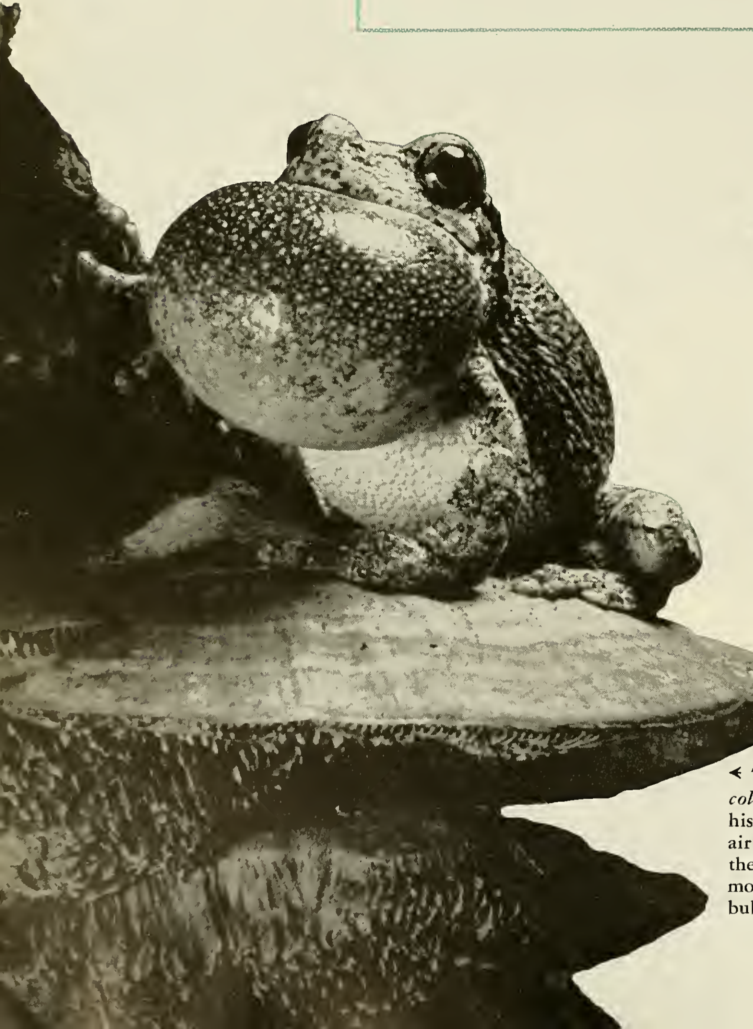
▲ A YOUNG TREE FROG *(Hyla versicolor),* perched upon a boy's finger to show its tiny size. This is by no means the smallest of the frogs. *Hyla crucifer* is even smaller

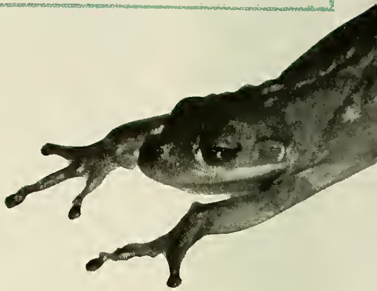
MEET
Some Tree Frogs

Their chorus is the serenade of spring, and—believe it or not—they make fascinating pets

By ROBERT HERMES

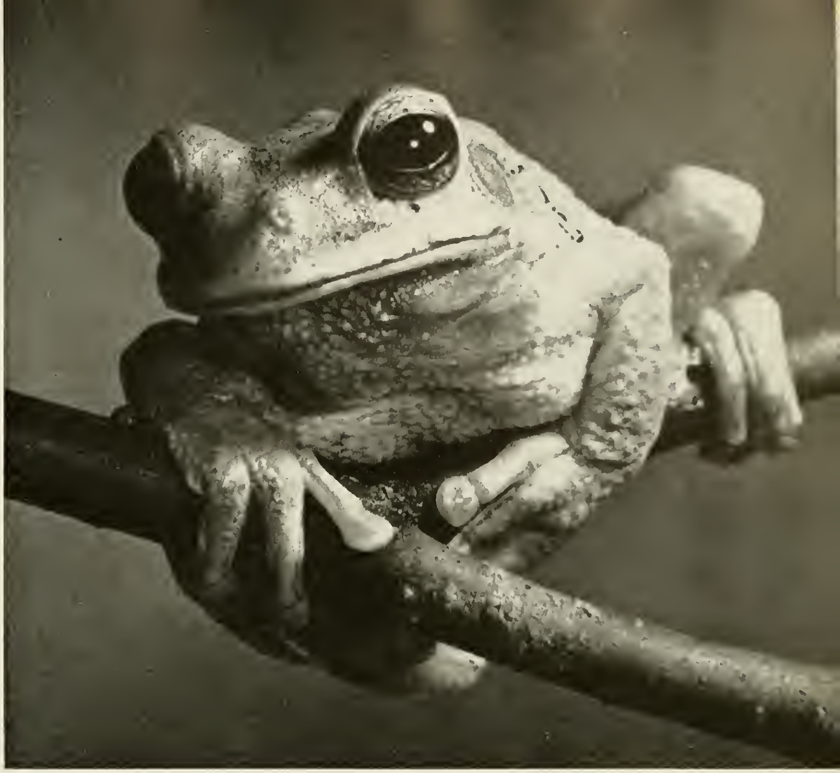
All photographs by the author





▲ A TREE FROG caught in mid-air with stroboscopic flash. Note how the fingers and toes are spread in preparation for the landing. This frog *(Hyla cinerea)* can jump 20 times its length. The eyes are retracted and partly closed as the frog flies through the air. The jump was made from an assistant's hand to a piece of cardboard held upright

◀ THE COMMON TREE FROG, *Hyla versicolor,* sitting on a bracket fungus, trilling his spring song. Tree frogs sing by forcing air back and forth between the lungs and the bulbous vocal sac through one or more slits beneath the tongue. The inflated bubble acts as a sounding board



▲ Sitting for his portrait, a Mexican tree frog. In observing these interesting creatures, the student of nature will one moment ponder over the gulf that separates them from us, and the next he may marvel at how closely one of them resembles a personal friend

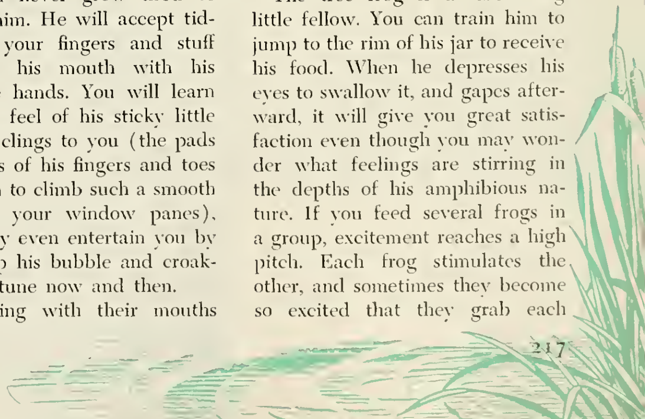
SPRING'S first concert in many parts of the world is made up of thousands of these small frogs. Having just emerged from hibernation, they break into chorus on a warm spring evening, and their bubbling songs bring joy to all who enjoy the outdoors and the freshness of growing things.

It will not be hard for you to make the acquaintance of various kinds of tree frogs if you search with a flashlight where the music is loudest. And if you live in an apartment where it is not possible to keep a dog or cat, or if you are not interested in the ordinary kind of pets and want something different and unusual, you can bring one of these interesting little fellows home. In him you will find a friend who will soon win his way into your affection with his comical actions and provide you with countless hours of enjoyment.

You will never grow tired of watching him. He will accept tidbits from your fingers and stuff them into his mouth with his human-like hands. You will learn to like the feel of his sticky little feet as he clings to you (the pads at the ends of his fingers and toes enable him to climb such a smooth surface as your window panes), and he may even entertain you by blowing up his bubble and croaking out a tune now and then.

Frogs sing with their mouths closed. The vocal chords vibrate from air forced back and forth through one or more slits between the lungs and the vocal sac or pouch. The air in the bubble-like vocal sac causes it to act as a sounding board.

The tree frog is a fascinating little fellow. You can train him to jump to the rim of his jar to receive his food. When he depresses his eyes to swallow it, and gapes afterward, it will give you great satisfaction even though you may wonder what feelings are stirring in the depths of his amphibious nature. If you feed several frogs in a group, excitement reaches a high pitch. Each frog stimulates the other, and sometimes they become so excited that they grab each



other. On occasion, one has swallowed my finger halfway before discovering its mistake.

In captivity, tree frogs sing their true song for only a short time, although vibrations of deep notes on radio or piano may cause them to croak. My frogs seemed always to respond to "God Save the King," but I am not implying that they were dissatisfied with the land of their birth or that they knew one musical score from another. Some newly-captured peepers sang so loudly one evening in the next room that we were unable to carry on a conversation. If your frogs never sing at all, they may be females, who, unlike their human counterparts, are almost voiceless. They have a warning croak but no mating call.

Tree frogs belong to a group of animals in which color change takes place. Some animals take on the color of their surroundings and in this way are better able to avoid their enemies. Others are stimulated to color changes by their emotional state. But the color changes of a tree frog are due to differences in light, temperature, and humidity. In light, dry, warm surroundings they tend to become paler. In cold, damp, and dark surroundings they become darker.

In the morning, your tree frog may be a deep brown and in the afternoon a bright Nile green. One day, he may wear a spotted coat, but the next there may be no trace of the pattern. His skin may have the translucent and waxy appearance of fine jade, but his eyes are shining jewels of gold and jet.

The cage for your tree frog may be a wide-mouthed glass container, in which you have placed an inch or so of water. You can make him more comfortable by placing an inverted glass inside to serve as a stool. Be sure to cover the jar with netting to prevent his escape. In summer, feeding him will be no problem, if you are good at catching insects; but in the winter you will have to raise your own. Mealworms are very easy to raise, and any pet store will start you for a few cents.

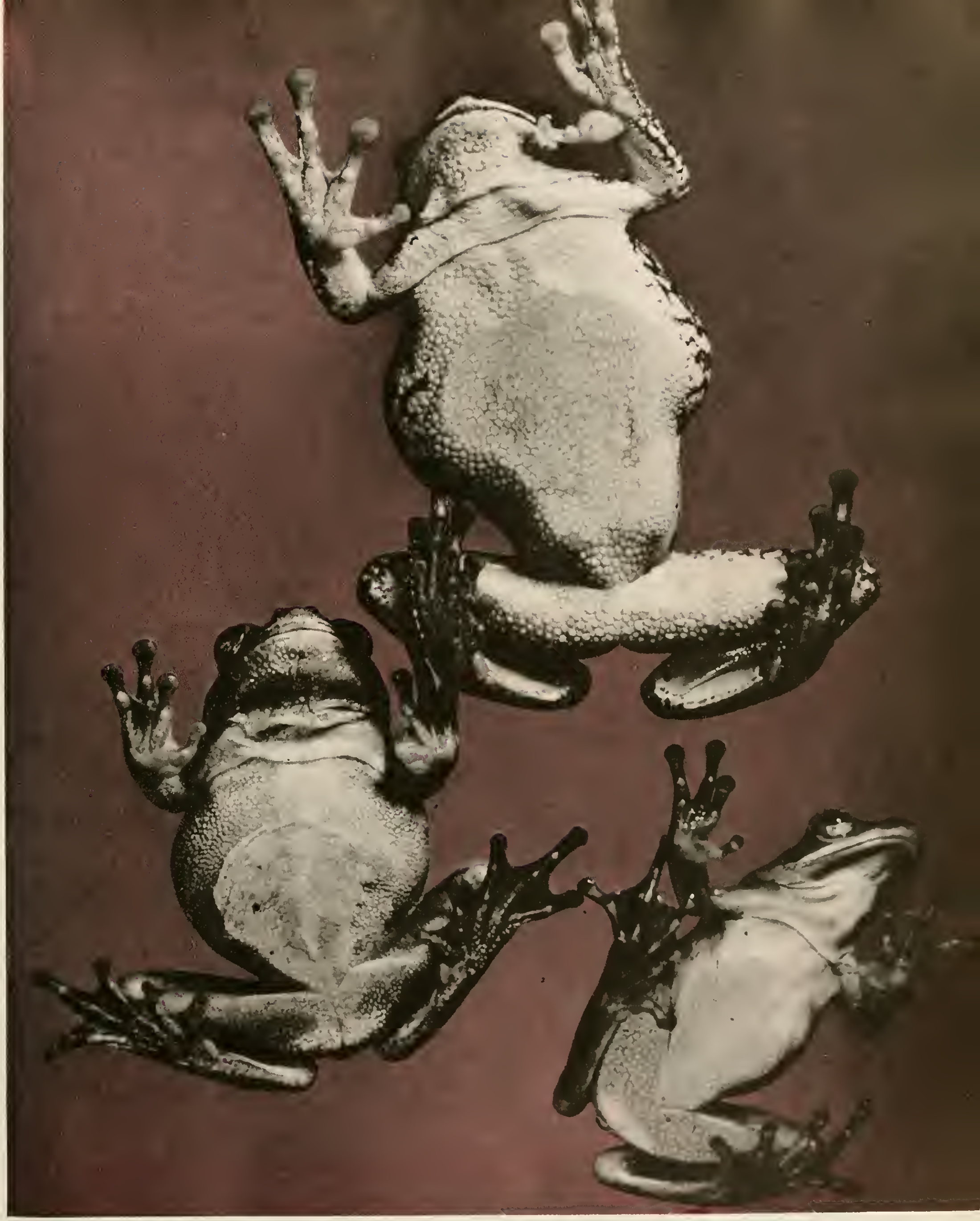
If you are going away on a trip, don't board him out. Just provide sufficient water and put him on the shelf, and he will be healthy when you come back two weeks later. Frogs, being cold-blooded, do not need to eat often.

Although frogs are easier to photograph than many other subjects, they can be very exasperating. I must admit that more of my time is spent chasing them under the furniture than posing them in front of the camera. Many times, it has been a question of who tires first, the frog or I. The high-speed stroboscopic light is the best means of photographing these animals, and my most interesting pictures of them have been action shots. Even the frog with the bubble extended could not be photographed sharply without a 1/5000-second flash, as the bubble is vibrating rapidly.

My most difficult problem was to photograph jumping frogs. For a long time, I could not find a way to control the direction of their jump. Then I hit upon the idea of using my fingers as blinders. In this way, I allowed them to see only in a limited area and

▲ **Climbing a bush.** Tree frogs are able to leave the pond and climb trees for food. Most of them prefer to stay out of water, though they must have plenty of moisture to survive

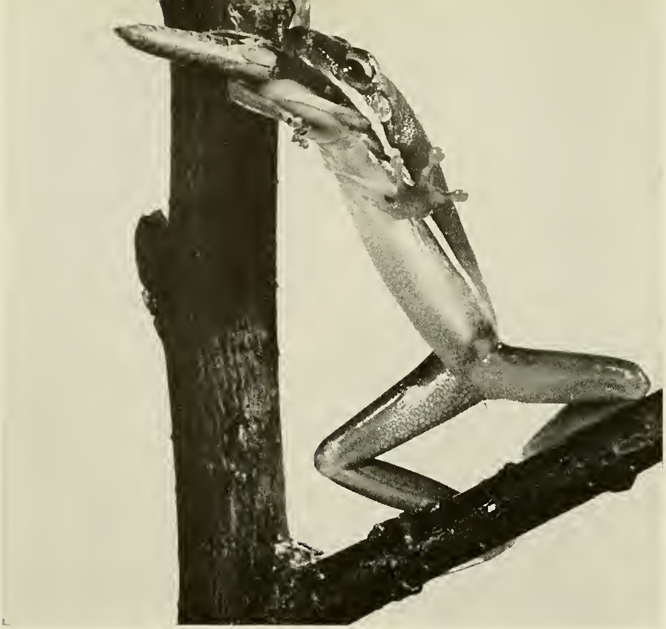
➤ **This pet frog** *(Hyla gratiosa)* has learned to accept his dinner happily from the fingers. Two or three meal worms will last him a week, but the food must be alive and moving. A less tame frog may eat more readily if the food is in front of him on a white tablecloth, where its movement is more conspicuous. Tree frogs become very tame in captivity



▲ THREE DIFFERENT kinds of tree frogs are shown here, holding onto an upright piece of glass. In this way you can study the sticky discs on their fingers and toes. The hind feet have five toes with short webs between, which aid in swimming. The front have only four fingers. Their stomachs are pressed against the glass for better support. *(Hyla gratiosa, Hyla baudinii,* and *Hyla cinerea)* thus obtained several good pictures.

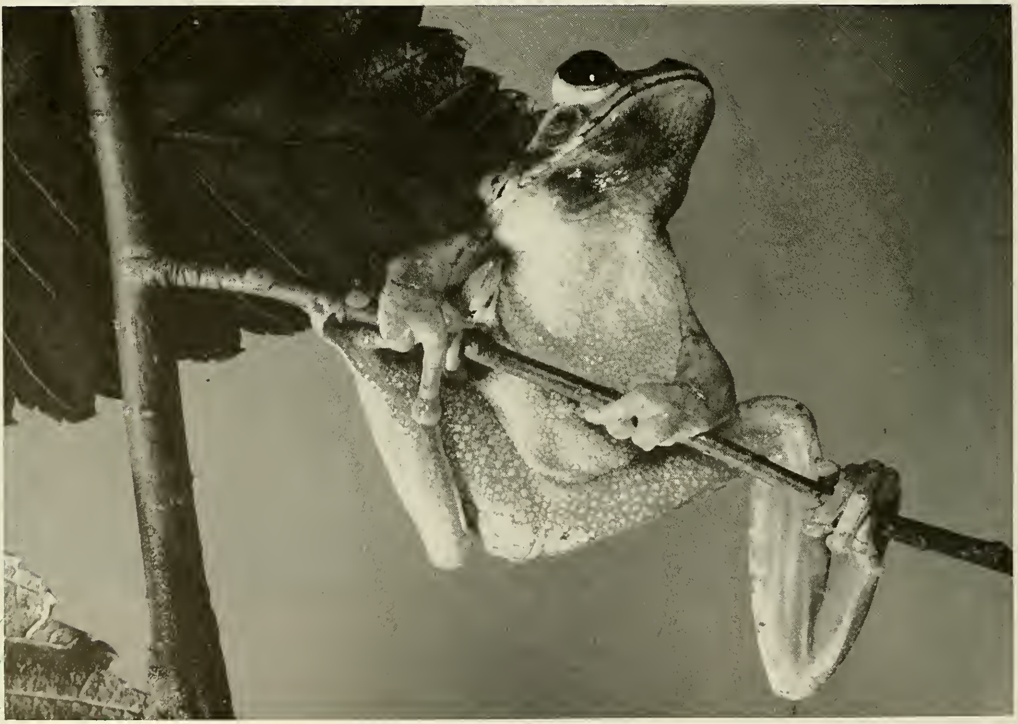
The time to find a tree frog is in the mating season when they go to the ponds to lay their eggs. A warm damp night after a rain is ideal. With a flashlight, cautiously approach the pond. When you get close, the frogs will hear or feel the vibration of your step, and the songs in the immediate vicinity will stop. But stand quietly for a few minutes, and one of the frogs will swim to a near-by hummock, climb out of the water, and continue his song. Snap on your light, and you may be fortunate enough to spot him by the reflection of your flash on his inflated bubble.

I have photographed many nature subjects, but I have found none of them more satisfactory to work with than tree frogs.



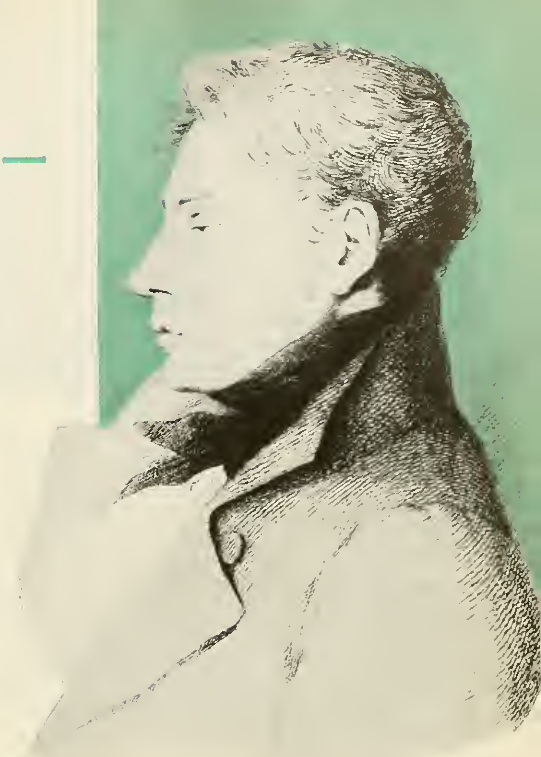
▲ In taking pictures of a large number of animals, one is bound to get some humorous poses. This frog has just captured a grasshopper. On first glance, one might suppose he was smoking his first cigar and caving in at the knees from the effects

▼ This is *Hyla baudinii,* ready to jump from a perch in a tree, possibly to get an insect on another branch



Boussingault—

Scientific Adventurer



At 20 years of age, this illustrious French scientist was thrust into 10 years of romantic exploration in South America.

This article is the first connected story of Boussingault's life ever published in English. The five volumes that constitute the *Memoires de J. B. Boussingault* are exceedingly rare. The only known set in the United States is in the Harvard Library.

With the article are reproduced for the first time some of the illustrations drawn by Dr. Désiré Roulin, a member of the expedition. They were discovered by the author in the possession of Roulin's descendants and were acquired through a grant given him by the American Philosophical Society for research into the lives of pioneer explorers of South America.

By VICTOR W. VON HAGEN

Part I

AN old gentleman sat by the window looking out at the morning. A generous sun was drinking up the dew of the meadows, gilding the vine-leaves on the hillocks and penetrating with its subtle flames the already ripening grapes. He was seated before his writing table, which he had drawn a little forward so as to watch the black-frocked Capuchin friars at work on the vines around the monastery of Liebfrauenberg.

Docteur Boussingault, continuing the dictation of his memoirs, was turning back the clock of his life and reliving his youth, which in the 1820's he had spent exploring South America. Age had blanched his light, wind-tossed hair and hollowed the smile in his cheeks, but he was still the charming octogenarian one sees in his portrait. He searched the whitened walls with his eyes as if half expecting to see the sought-for words printed there. Then in a voice of amazingly strong timbre, he found his words and gave them out to his daughter.

"Ah! this Manuelita," he said, and settled back into his chair again. His nimble blue eyes made brief movements, charming in their abruptness, as he recaptured in his memory the exploratory exploits of his debonaire twenties. "Ah, this Manuela, this mistress of Simon Bolivar. What an amazing person she was. Such weakness, such lightheartedness, such courage, such devotion. She did not admit her age. When I knew her, she seemed to be 29, and she was then in all the burst of her unbalanced beauty; handsome light figure, brown eyes with a sort of indecisive look, pink complexion on a white background, black hair. She had a leaning toward mockery, and she was said to possess a secret charm to make herself loved."*

Even as Madam Holzer, Boussingault's beloved daughter (Berthe Gabrielle) was writing down these Boccaccian anecdotes, she must certainly have been well aware that they might prove to be the most amazing memoirs ever written by a man of science. For here was her father, Dr. Jean Baptiste Joseph Dieudonné Boussingault, Member of the Institute of France, Officer of the Legion of Honor, one-time President of the Academy of Science, founder of scientific agronomy, and author of the celebrated "*Economie rurale*" and hundreds of other scientific papers on soil-chemistry,—instead of remembering

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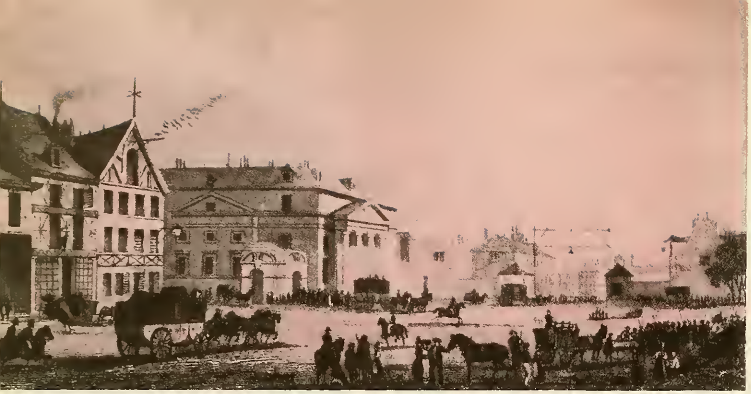
* The five-volume Memoirs of Boussingault are now being translated and edited by the author and Mrs. Kenneth Johnson for eventual publication. Boussingault's personal narrative was used by the author for his book *The Four Seasons of Manuela*, which is being published this month by Little Brown and Duell, Sloan and Pearce.—ED.



▲ **The scene** of Boussingault's earliest recollections: the district of Saint-Denis as it appeared early in the last century

about temperatures, barometers, and sextants—reminiscing instead about the people he knew in his full and wonderful life.

His friends, the savants of France, had urged upon him the task of writing his scientific memoirs, to give them a connected narrative of his explorations in South America, following the wake of Humboldt. But no one expected that out of this suggestion would come such a personalized account. Boussingault was now like a rabbit in a bed of thyme. He ran and leaped about wherever it entered his head to do so. He was reaching far back into this memory to more than 60 years ago, when as a young man he had left on a scientific mission to South America, carrying a letter of introduction to General Simon Bolivar from Alexander von Humboldt.

All this has its bit of irony, too, for no one now remembers the name of Boussingault—unless one is a student of the history of science. His chemistry papers gather dust; time has passed them by. But his memoirs, those five rare volumes of piquant observations, vibrant and alive, telling of the persons and places he knew in his time and giving us lively pencil portraits of the leaders of the South American wars of independence—these are unique in Latin American literature. And of even more persuasive interest are his own frank revelations about himself; for is it not candid confession that causes good autobiographies to remain always in fashion? No one today reads Jean Jacques Rousseau's *Emile* or *The New Heloise,* but his *Confessions* will be read forever. In his own autobiography, Boussingault depicts himself as he is or was without disguise, his pride only tempered by irony. How rare it is for a savant to allow himself to be seen stripped of his wrappings—shorn of the chiton that usually surrounds an immortal's dignity and conceals the fact that he did not spring full born from the brows of Zeus. In this mood, he tells us of his beginnings:

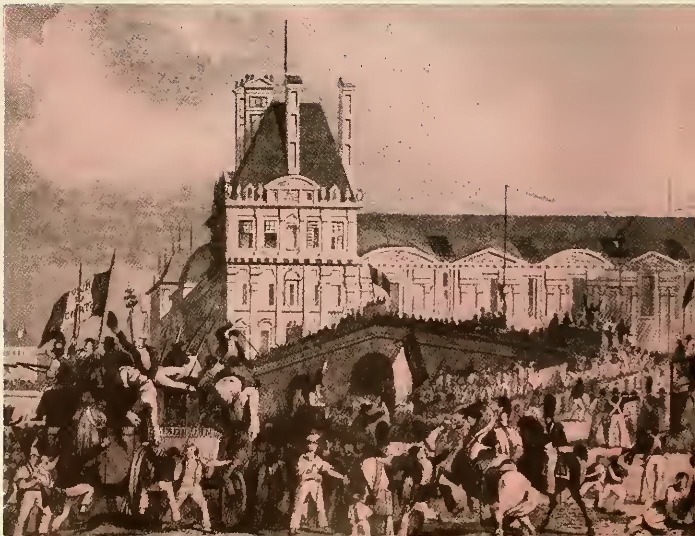
"My oldest remembrances carry me back to a house which I have since known was on the Rue Saint Louis, which is now called the district of Saint-Denis; it was once a convent and used then as a warehouse for military stores for the First Army Division of Paris, for which my father was supply-keeper. I remember very little . . . drums, fifes, soldiers, big trees, hunger . . ."

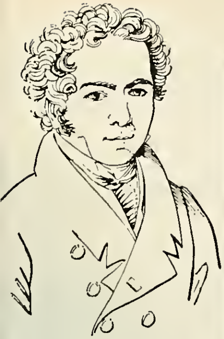
Young Jean Baptiste Boussingault was virtually nourished on the lap of Mars. He was born in the beginning of the Napoleonic era, on the first of February, 1801, and the memories of Bonaparte's ill-fated venture in Egypt still hung fresh in public minds. All France was one gigantic barracks.

His father was a war veteran—a pensioner as proud as Artaban and as poor as Job. At forty years of age and after innumerable love affairs, the elder Boussingault had married an innocent girl named Mlle. Elizabeth Munch of Alsace, who during their entire courtship understood not a word of her ardent suitor, since he spoke only French and she only German. But "I am sure," said Boussingault, "they loved each other because of their obvious qualities; otherwise I could not explain the marriage of my parents."

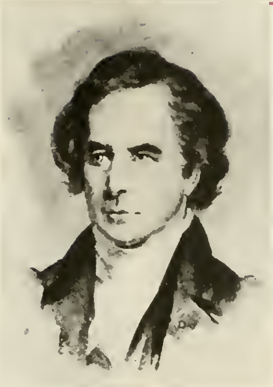
Charles Boussingault had been seriously wounded with the dragoons in the Army of Condé and in the retreat had been abandoned at Wetzlar. There the daughter of the burgomaster (worth, *en passant,* 100,000 francs) picked him up for

▼ **A lively** street scene in the turbulent Paris of Boussingault's day: departu of the populace for the summer residence of the presidents of the French Repub

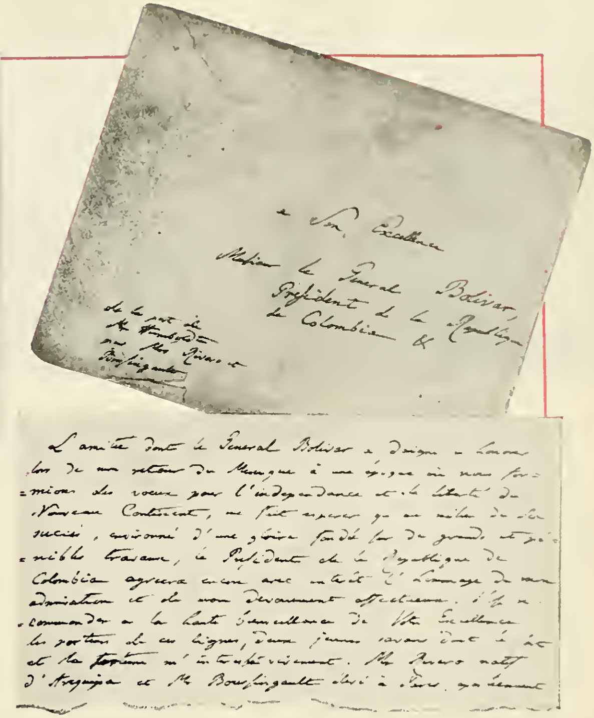




▲ L. J. THENARD, famous chemistry teacher



▶ DOMINIQUE FRANÇOIS ARAGO, celebrated astronomer and physicist of Boussingault's day



a Son Excellence
Monsieur le Général Bolivar,
Président de la République
de Colombia &

de la part de
M. Humboldt
par Mrs Rivero et
Boussingault

L'amitié dont le Général Bolivar a daigné m'honorer
lors de mon retour du Mexique à une époque où nous for=
=mions des voeux pour l'indépendance et la liberté du
Nouveau Continent, me fait espérer qu'au milieu de ses
succès, environné d'une gloire fondée sur de grands et pé=
=nibles travaux, le Président de la République de
Colombia agréera encore avec intérêt l'hommage de mon
admiration et de mon dévouement affectueux. J'ose re=
=commander à la haute bienveillance de Votre Excellence
les porteurs de ces lignes, deux jeunes savans dont le sort
et la fortune m'intéressent vivement. Mr Rivero natif
d'Arequipa et Mr Boussingault élevé à Paris, qui tiennent

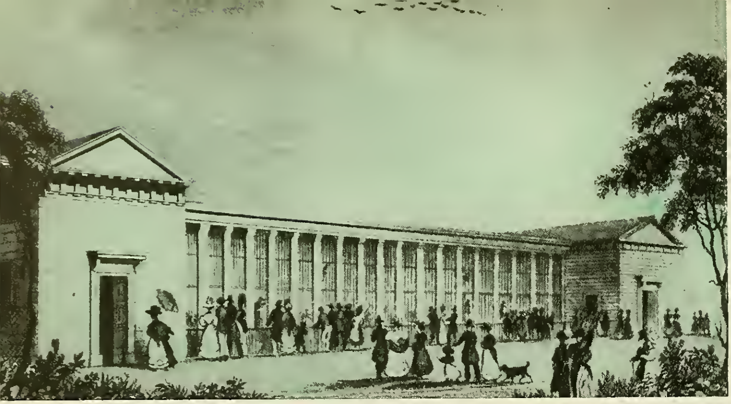
▶ FRAGMENTS of the letter written by Alexander von Humboldt to General Bolivar on behalf of Boussingault and Rivero. In part the letter reads: "I dare to recommend to your benevolence the bearers of these lines, two young scientists in whose destinies and future I am most interested. . . They belong to that small number of fortunate people whose talent and solidity of scientific knowledge call for public attention at an age when others are still busy with the slow development of their talents."

dead, nursed him to life, and then assented, by means of the universal language of love, to marry the Parisian. The elder Boussingault was a handsome man of fresh complexion, blue eyes, and jet black hair. He was gracious by nature and possessed "very polite manners," which, the son tells us, "were rare enough among the petit bourgeois of the revolution." As to the family name—of which they seem to have been the only possessors, Jean Baptiste liked to think that he was a descendant of a wine merchant whom the seventeenth-century dramatist Molière satirized in his *Satire du Repas*. "J'ai quatorze bouteilles d'un vieux vin." Molière wrote, "Boussingo n'en a pas de pareilles." ("I have fourteen bottles of ancient vintage wine . . . Boussingo has nothing to compare with them.")

It was in this Paris of 1807 that young Boussingault began remembering his childhood. Everywhere there was chaos, misery, and a rain of blood. There was then, as he remembered it, no industry, no work, no food. On the Street of the Parchment-makers, where his father—now a tobacco-monopolist—kept his small store, the people were the most miserable of Paris. But here young Jean Baptiste learned to play the drum and to look in occasionally at Le Père Enault, housepainter and wallpaper maker. Oftimes he pressed his nose to the windowpane behind which engravers plied their trade.

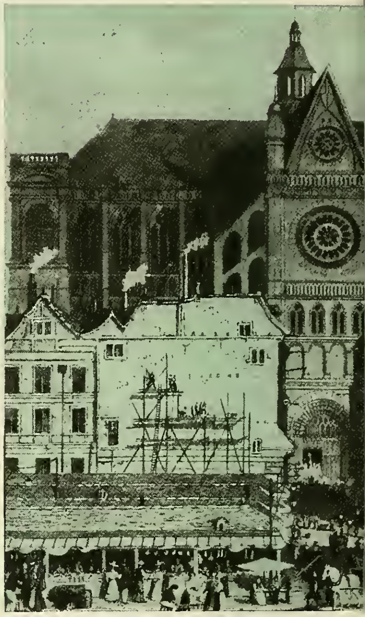
The revolution was still living, and the little man who kept the cleaner's shop on the Rue Saint Jacques—a man who had once been the President of the People's Court—, still bragged of the time he had slapped the face of the Dauphin when the child was jailed in the "Temple." Jean Baptiste's playmates used to run after this man shouting "*Semptembriseur*," because this M. Marc, with the parched skin, hectic cheeks, and thin hair covered by a *sans culotte* cap, had taken part in the massacres of September, 1792.

When Jean was not listening to the old soldiers, he was in the fencing salon, learning "thrust and parry from Corporal Laurel." This he somehow sandwiched in between his school classes. He went at the age of eight to the Lycée Imperial where he "learned nothing." He says that "from the 6th form, where I understood very little, I went to the 5th, where I understood even less . . . then to the 4th and the 3rd, where I understood nothing at all. We went from class to class like the ingots of iron in a rolling mill." He remembered only that his classes were ornamented by Professor Couenne, an old dragoon "who had part of his right buttock shot off by a cannonball." The brave man wore over the place of his missing buttock a pad shaped like a pin cushion. "When one committed the slightest blunder in his classes, it was the custom—and a very humiliating one, too—to be made to kneel near the master's chair. The punished student, while the old professor held forth, would amuse himself by sticking pins in the cotton 'rump' of the old dragoon. One day a pupil, placed on the wrong side, stuck a needle in the wrong buttock; you



◄ THE JARDIN DES PLANTES, where Bou singault studied under Baron Cuvier, wit a "dreadful mixing of the sciences"

▼ THE CHURCH OF ST. EUSTACHE, o posite which Boussingault resided whil preparing for his departure to Sout America



can only imagine what happened!"

The year 1812 threw classes into an uproar—Napoleon had invaded Russia. And so they lived this war, the retreat, and the conspiracies of Paris. Everyone was afraid to talk of events. "During these times, everyone spoke in low tones, even *en famille,* on political affairs." After the rout in Russia, the thin faces appeared again on the streets of Paris and famine was upon them. Young Jean remembered "the distribution of 60 rations of soup, consisting of only two herrings in boiled water. Yet Boussingault, in his enthusiasm, quitted the mire of that horrible present to soar into the empyrean, for he had become fascinated by chemistry. His schoolmate Loubry had entered the classes of the renowned Professor Thénard, and through him young Jean learned of the mysteries of the test tube. His little German-speaking mother managed to buy him the four volumes of the *Traité de Chimie Elémentaire* by Thénard, which enthralled him. In time, he was taking classes with Lefebvre, Gineau, and Gay-Lussac. Then, with a "dreadful mixing of the sciences," he attended the classes of Baron Cuvier at the Jardin des Plantes.

"It is in this manner that I made my introduction to science." In the spring of 1814, young Jean had to stop his studies. "Everyone seemed to be living in the streets, awaiting the dreadful news." Reversals everywhere, the Allies were closing in on Paris, peasants pouring into the capital with all their belongings. On March 30, there was fighting in the streets of Paris. Jean, with all the other students of his age, was pushed into the army and, in his college uniform, he stood with a carbine in trembling hands at the Pont Neuf. However, Jean Baptiste did not stem the tide of events. The Allies came into Paris, and he went back to his classes.

Jean Baptiste possessed all the plasticity of youth. Politics were of little moment; it was his future he worried about. He did not want to enter business, "as his readings had taken him into the realm of other tastes." He applied for admission to the School of Mines at Saint-Etienne, because of the scientific opportunities it offered. So, as the winter of 1818 approached, he went south by foot to his school, attired in the pale blue uniform with its symbol of mining—twin golden peaks on the collar. On his broad back he wore a great blue redingote; in his rucksack were all his clothes, and in his pants—fifty francs.

At the school, he learned the techniques of mining, studied chemistry, and specialized in the evidences of silicon in iron. Between classes he read. "I read everything," he declares. "I read literary works, travel, and history. And I read in my bed at night." All this went on for one year at the Mining School.

One year later, his one formal year of instruction over, he left Saint-Etienne. In his December years, Boussingault remembered that day . . . "I set out for Paris, my rucksack on my back, my miner's hammer in my hand, and in the pocket of my pale blue uniform, my first study 'On the Combinations of Silicium'; all this was the basis of my scientific fortune."

And it was. For on his arrival, he went boldly to the laboratory of Joseph Gay-Lussac, the celebrated chemist, and showed him his paper. Tall, middle-aged, and serious, with tired eyes eternally looking through thick-lensed glasses, Gay-Lussac gazed at the tall young man standing before him. He peered into Jean Baptiste's blue eyes, took in the olive-hued countenance dominated by a generous nose and a great flow of hair, combed *coup de vent* in the romantic tradition, and he knew he looked upon a young man of promise. "You should publish it," he said. So that is how Boussingault's first scientific paper was published in the

Annales de Chimie et de Physique —when he was only eighteen years old.

Now he left to become technical assistant to the mines near Strasbourg at Bas-Rhin. "I must say that at Lobsann I lived underground." And while living in the subterranean, he was approached by an agent of the Pasha of Egypt with an offer to go to the Nile—at 6000 francs the year and a commission in the army—to search out new mines. Even as he hesitated, a new offer, in the opposite geographical direction, came in the person of Francisco Antonio Zea. Now it was the newly-created Republic of Gran Colombia that was looking for scientists to gauge its natural wealth and to establish technical schools within its realms. Don Antonio explained how the interminable wars that had freed Colombia from Spain had also, in the process, wiped out its intellectuals. General Bolivar was determined to re-institute the schools, to establish Museums, and to acquire through science an outline of Colombia's resources.

Zea himself was a distinguished botanist who had studied under the immortal Mutis in Colombia. But when he was discovered distributing the Spanish translations of the French *Declaration of the Rights of Man,* he was trussed up, tried in star-chambers proceedings, and shipped off to a dungeon in Spain, from which he emerged to become the Director of the Botanical Garden at Madrid. There he remained until General Bolivar was on the loose again, whereupon he left for Gran Colombia to join him. Zea was clever, vain, and well able to express himself, but he was often intoxicated with his own brilliance.

He had now traveled to Europe to establish faith in Colombia's solvency, secure it recognition, and recruit a corps of scientists. Boussingault had been recommended to him by no less a person than Baron von Humboldt. Zea was pleased to offer Boussingault 7000 francs a year on a four-year contract, a title of colonel on the general staff, dress uniforms, and transportation to America on a warship.

Boussingault gave the proposal only a moment's survey. "There were live volcanoes in the Andes; here I had only the burnt-out ones of Auvergne; I did not hesitate to accept the adventure."

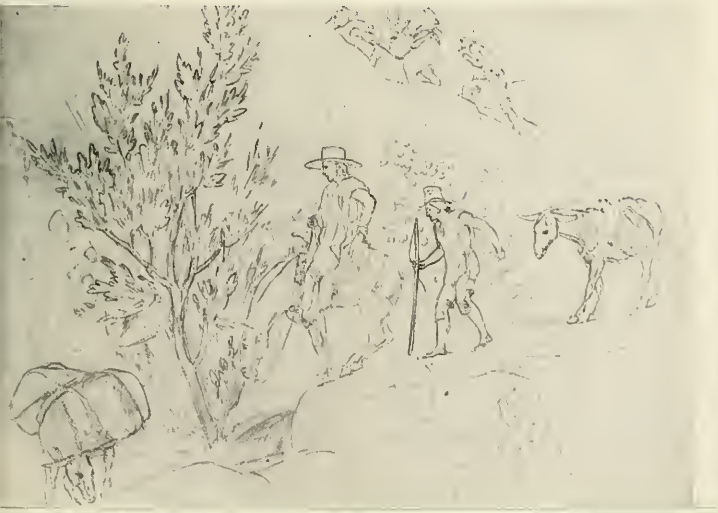
So by June, 1821, he was in Paris calling on Don Antonio Zea at his lovely apartment on the Rue Caumartin and collecting 2000 francs in advance.

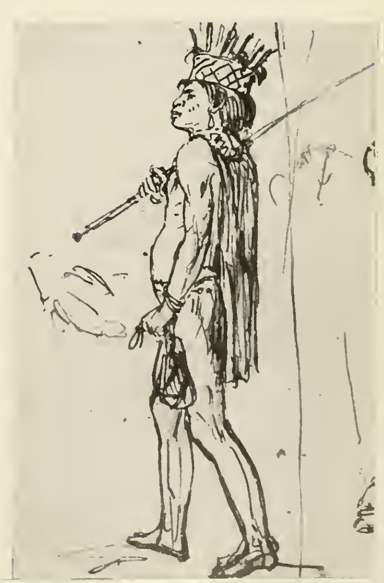
He met Mariano de Rivero. Don Mariano had an indefinable quality that was rare and yet chimerical. He was a Puruvian, born in Arequipa and educated for the sciences at the Sorbonne. His blood was blue, his eyes mischievous, and his manners exquisite. Together the Peruvian and the Parisian set up their headquarters at the Rue des Prouvaires across from the Church of Saint-Eustache and began preparations for the expedition, which was to leave in October.

Rivero, with charming Latin forgetfulness, left for London. He left Boussingault with all the worries of the expedition, which were somewhat tempered by the knowledge that the great Alexander von Humboldt had promised to visit him. In Rivero's apartment that morning, while Boussingault was working on a mound of papers, a woman entered. She was young and pretty, perhaps 30 or 35, and he knew her to be Rivero's mistress. She inquired for Don Mariano and then, learning he had really gone to London, tried to give Boussingault a letter, demanding at the same time that it be sent to him. With that, she went into a crying fit and fainted in Boussingault's arms. He carried her to the couch, threw water on her face, and was busy chafing her hands, calling frantically to her when in

Continued on page 234

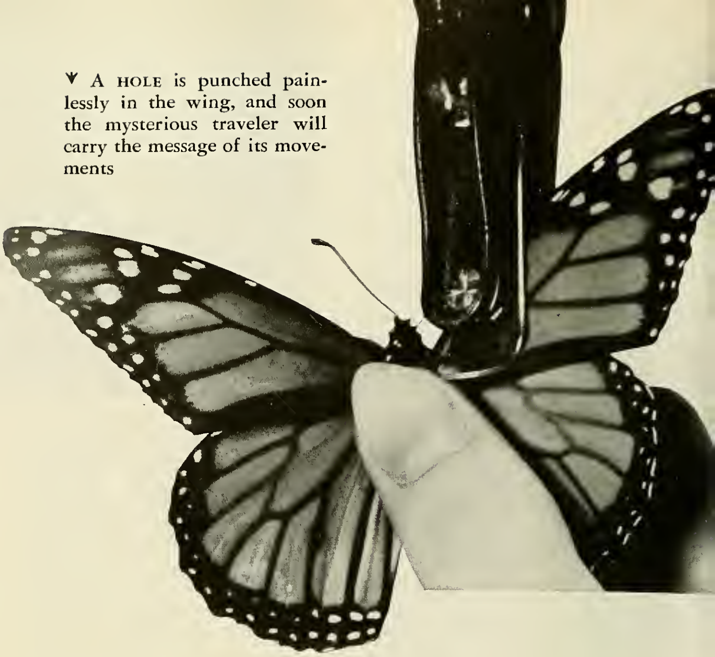
'WO SKETCHES by Désiré Roulin, official artist of the expedition: *Below,* tra- elers on a mountain trail in Colombia; *at right* an Indian of the region





Marked Monarchs

By F. A. Urquhart



A HOLE is punched painlessly in the wing, and soon the mysterious traveler will carry the message of its movements

EVERY year the brilliant orange-and-black butterflies known as monarchs collect in great numbers in preparation for their southward flight. Trees at the margins of lakes and ravines may become covered with masses of these golden creatures, clinging to the leaves and branches so that the trees seem to be laden with butterfly blossoms stirring gently in the breeze. Clinging upside down with wings folded, the butterflies remain almost motionless on the branches during the night. Then, on a sunny autumn morning, they take wing, one by one, and flutter high into the sky like so many wind-blown petals against the broad expanse of blue, to disappear from sight.

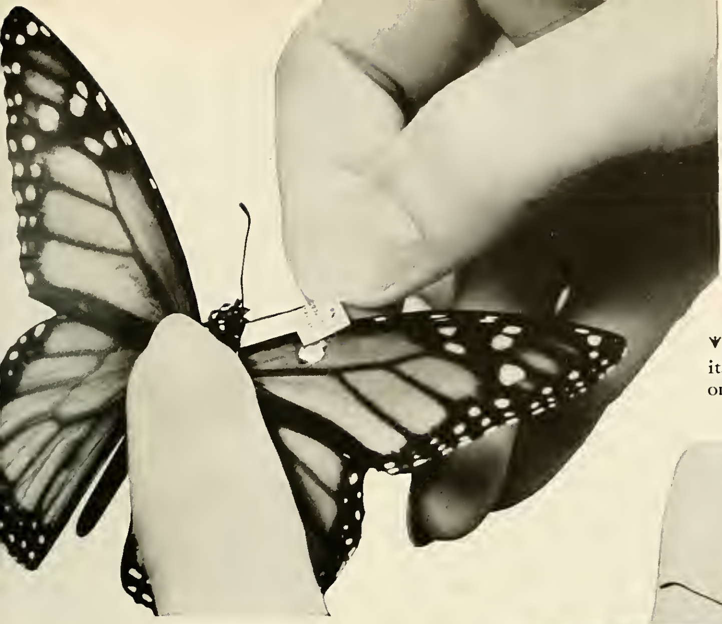
Exactly where they go, no one fully knows. They leave the northern United States and Canada any time from the middle of August to the middle of September. For thousands of miles on their perilous journey southward they fly during fair weather and rest when the weather is stormy. Some observers have seen them flying over New York State in September; others have reported seeing them as far south as Oklahoma and Texas in October.

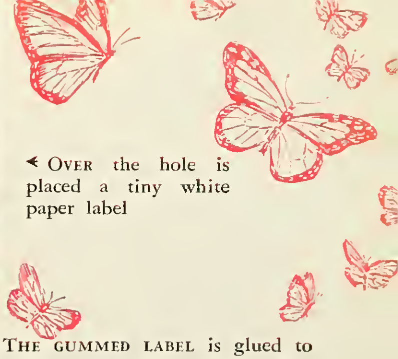
Do the monarchs fly south in independent groups, or do they join with other bands on their migration? How far south do they go? Where do they stay during the long, cold winter months? Do the same butterflies that hibernate in the south return to their northern home, or do they retrace part of the journey and then die, leaving their offspring to complete the mission? We are getting answers to some of these questions, but many of them remain unanswered, even though a number of persons have attempted to trace the flight of these mysterious travelers and have recorded their observations.

It is scarcely any wonder that there have been conflicting reports about the movement of the monarch butterflies. Imagine trying to follow a featherweight insect flying about 400 feet above the earth. Add to that the vast area in which these fragile creatures fly and the numbers that die during migration, and you will realize some of the difficulties involved.

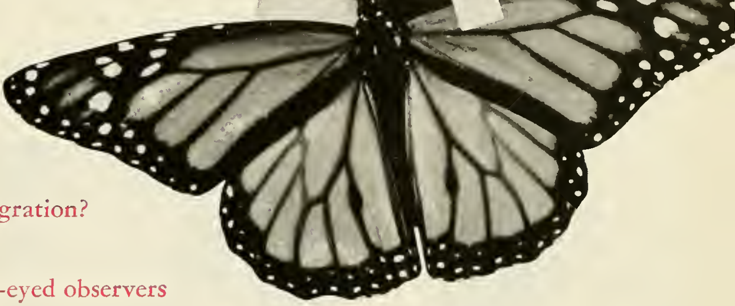
It is obviously not possible to place small bands on the legs of butterflies like those used in banding birds. Various other methods have, however, been tried. Some scientists have tried putting stain on the wings of the butterflies; but this method is impractical, for there is nothing to indicate the meaning of such a mark, and the person finding the butterfly does not know what to do with it.

Other scientists have tried gluing a small printed label to the butterfly's wing so that the insect can be identified if found. But the chief difficulty here is the tendency of the glue to dry, allowing the label to drop off. There is also the probability that the added weight of the label and glue will interfere with normal flight. Scientists who have attempted to use this method have also reported that there are certain definite disadvantages when attempting to band large numbers of specimens. The scales must be removed from the wing before the label can be glued on satisfactorily. A drop of glue is then applied to the descaled area, and the label is placed on the glue and pressed firmly into place. This procedure entails a considerable amount of time for each specimen handled, and care must be exercised to pre-





◂ OVER the hole is placed a tiny white paper label



▾ THE GUMMED LABEL is glued to itself through the hole. If you find one, let the Museum of Toronto know

Did you know
that every spring and autumn
in the United States and Canada
thousands of butterflies
flutter thousands of miles in migration?
Many of them carry numbers,
and you may be one of the sharp-eyed observers
to help trace these mysterious travelers

vent the glue from getting on the tiny labels in the box and causing them to stick to one another.

Still another method of identification has been used by Mr. C. A. Anderson, of Dallas, Texas. He brands the butterflies with a rubber stamp, using a special check-protection ink, as noted in NATURAL HISTORY for May, 1950. A special number consisting of a letter and one or two digits is used, for example Y 32. Each insect receives a different serial number, and the marking is made on the outside of each of the four wings. Mr. Anderson's address, in case any butterflies bearing his code numbers are found, is: 3209 Centenary, Dallas 5, Texas.

The last-named method of marking migratory monarch butterflies has, it would seem, one distinct disadvantage. Unless the observers are aware of the significance of the marked specimens, they will not know to whom the information should be sent. To overcome this difficulty, a most successful method was originated at the Royal Ontario Museum of Zoology and Palaeontology, in Toronto, Canada.

Scientists there simply punched a hole in the wing of the butterfly with a paper punch. Over this hole, which was made immediately behind the stout marginal vein of the wing, was placed a tiny white paper label—about a half inch by a quarter inch—bearing the instructions "Return to Museum of Toronto, Canada." A field number was also written in pencil on this label, which showed who had tagged the specimen and where it had been tagged, such information being recorded at the time the butterfly was released. The gummed label was folded over the edge of the wing and glued to itself through the hole. The weight of the label partly compensated for the piece of wing that had been removed, thus keeping the butterfly's flight as normal as possible.

With this equipment, butterfly banders went to the margin of Lake Ontario, where they found trees laden with migrating monarchs. One by one they removed

Hugh M. Halliday photo

▲ THE LARGE, gaudy caterpillar of the monarch butterfly is striped yellow, green, and black

Hugh M. Halliday photo

▲ THE CHRYSALIS is jade green—like a tiny lantern studded with spots of gold. It hangs by a thin black stem. Upon emerging, the butterfly clings to the old skin of its chrysalis

the delicate travelers from the trees, punched a hole in the wing, glued on the label, and released the insect to begin its flight. The field numbers were placed on the tiny labels before they were taken from the laboratory, and each label was bent, ready to be placed over the butterfly's wing. In this way, it took an average of 8 seconds to band one butterfly, or only an hour to band between 400 and 500. Over 3000 specimens were marked in this way. Of these, only 7 have been returned to the Museum. The specimen that had traveled farthest had reached Hamilton, a city also on Lake Ontario, 40 miles southwest of Toronto. Another specimen was collected 20 miles north of the point where it was tagged.

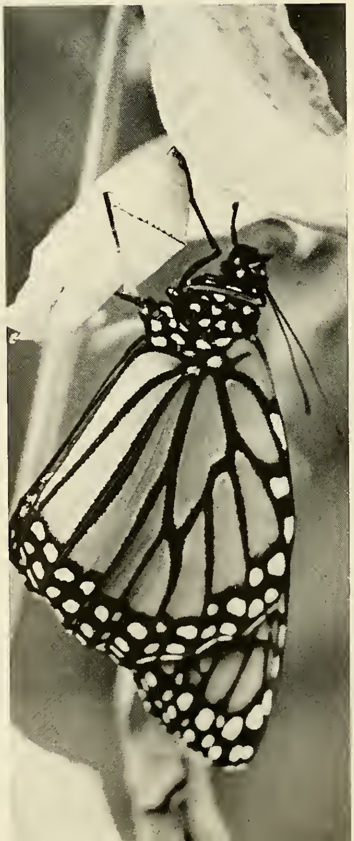
On the face of it, these results seem discouraging, but when one considers the area covered by the butterflies in their flight, the numbers that die en route, and the possibility that a marked specimen might not be found, they are not so surprising. It does, however, give some indication of the amount of work that will be involved if we are ever to find out where the monarchs go when they leave their breeding grounds in the fall.

Although thousands of these butterflies wing their way south every fall and thousands return to their breeding grounds every spring, very little is known about their hibernation. They have been known to hibernate in Apilochicola, Florida, and at Monterey, California. There they stay among the pine trees on the high boughs, going out in search of food in the daytime and returning at night to the same trees. They remain there from November until March, resting quietly with wings folded, clustered on the trees during stormy weather and moving about only when the weather is calm.

After staying for months in these localities, they leave for the north and move, not in masses as in their fall migration, but individually. This makes their return flight more difficult to trace.

Whether or not the butterflies that hibernate in the south are the same ones that return to the breeding grounds in the north, we do not know. In view of the fact that monarchs have been observed mating before leaving their winter home, it is possible that the females journey only a short distance northward before laying their eggs. Thus, a second generation of butterflies may be produced en route and so on, so that the monarchs reaching the more northerly parts of their range may be individuals of a second or even a third generation. Only careful observation of the butterflies during migration, together with study of their life cycle in various localities, will yield the information on which the answer to this part of the question can be based.

In any event, the butterflies that return to the breeding grounds look weary and travel-stained, their bright orange wings faded and tat-



➤ THE WINGS gradually expand to their full size, still remaining limp for a time. Whither will its long journey take it? As described in this article, marked monarchs may lead investigators to the answer, if the public co-operates sufficiently tered. After returning to northern United States and Canada in May and early June, the females seek out the tender green leaves of the young milkweed plants on which to lay their eggs. Here the female alights, curls her abdomen under the edge of the leaf, and deposits a tiny, yellowish, waxlike egg about an eighth of an inch in length, on the underside of the leaf. After she has repeated this performance more than a hundred times, she falls to the ground, her drab and tattered wings moving feebly, there to die of exhaustion or be devoured by some insect-eating creature. Her life cycle has been completed.

The living egg remains on the broad leaf day after day until about a week or ten days have elapsed. Then a little hole, about the size of a pinhead, appears on the tip of the egg. Gradually a tiny, black caterpillar wriggles forth, leaving the empty "eggshell" clinging to the leaf.

Shortly after emerging, the caterpillar begins eating the leaves of the milkweed. His tiny jaws clip away at the edge of the leaf like a minute pair of scissors. So great is his appetite that within a short time his plump little body becomes too large for his skin. When this point is reached, he spins a silken carpet on the upper surface of a leaf, to which he attaches his many pairs of legs. His skin splits down the back, and he crawls out with a new and much more elastic skin. This performance is repeated five times, until finally he emerges as a large, gaudy caterpillar weighing many hundreds of times his original weight. The caterpillar is striped yellow, green, and black and resembles a string of multicolored discs. Full grown, he now goes in search of a suitable place in which to enter the chrysalis stage. This place may be on a log, a tree, or a building.

Having chosen his site, he begins to weave a carpet of silk on the underside of the supporting object. This he does by secreting, from his mouth, an almost invisible fluid, which hardens as soon as it comes in contact with the air, becoming a strand of very fine silk. He draws the silk from side to side; and after repeating the process many thousands of times, he has woven a dense mat of silvery white about the size of a ten-cent piece. This accomplished, he fastens the hind end of his body to the mat and hangs curled up like an inverted comma, swaying very gently in the breeze.

Suddenly his skin splits open, and, as if by some magic, the ugly caterpillar is transformed into a beautiful chrysalis. The chrysalis is jade green and looks like a tiny lantern studded with spots of gold, suspended from a thin black stem. This jewel-like pendant hangs motionless for about a week, its glossy green surface shining and the gold studs winking in the sunlight.

Again, there is a magic transformation. The beautiful green and gold of the chrysalis vanishes, and we see instead a transparent skin, through which can be seen the outline of the butterfly ready to emerge. Now there is another dramatic change. The transparent skin splits and the butterfly is revealed, clinging to the old skin of the chrysalis.

On first emerging from the chrysalis, the wings of the monarch are small, about the size of a thumbnail, wrinkled and limp. The wings gradually expand to their full size; the wrinkles disappear, but the wings remain limp. At this point, the butterfly begins moving the wings slowly back and forth, and this helps dry them out. This performance may last for from one to three hours, at the end of which time the wings have become smooth, stiff, and parchment-like. Now the monarch's brilliant orange wings, with their delicate tracing of fine black veins, have a spread of about four inches. The wings are completely covered with countless thousands of microscopic scales overlapping each other like the shingles on a roof. They form a completely waterproof covering for the wing membrane and impart the brilliant contrast of orange, black, and white by which we recognize the monarch butterfly. In place of the scissors-like jaws of the caterpillar, the butterfly has a long, threadlike sucking tube which is coiled like a watch spring and tucked away neatly under the butterfly's head, ready to be unwound and thrust into the nectar-containing corolla tubes of many kinds of flowers. In some sections of North America, we know that there may be three or four generations in one year. And rearing experiments that have been carried on in certain localities suggest that only the generation occurring in late summer or fall probably takes part in the southward migration.

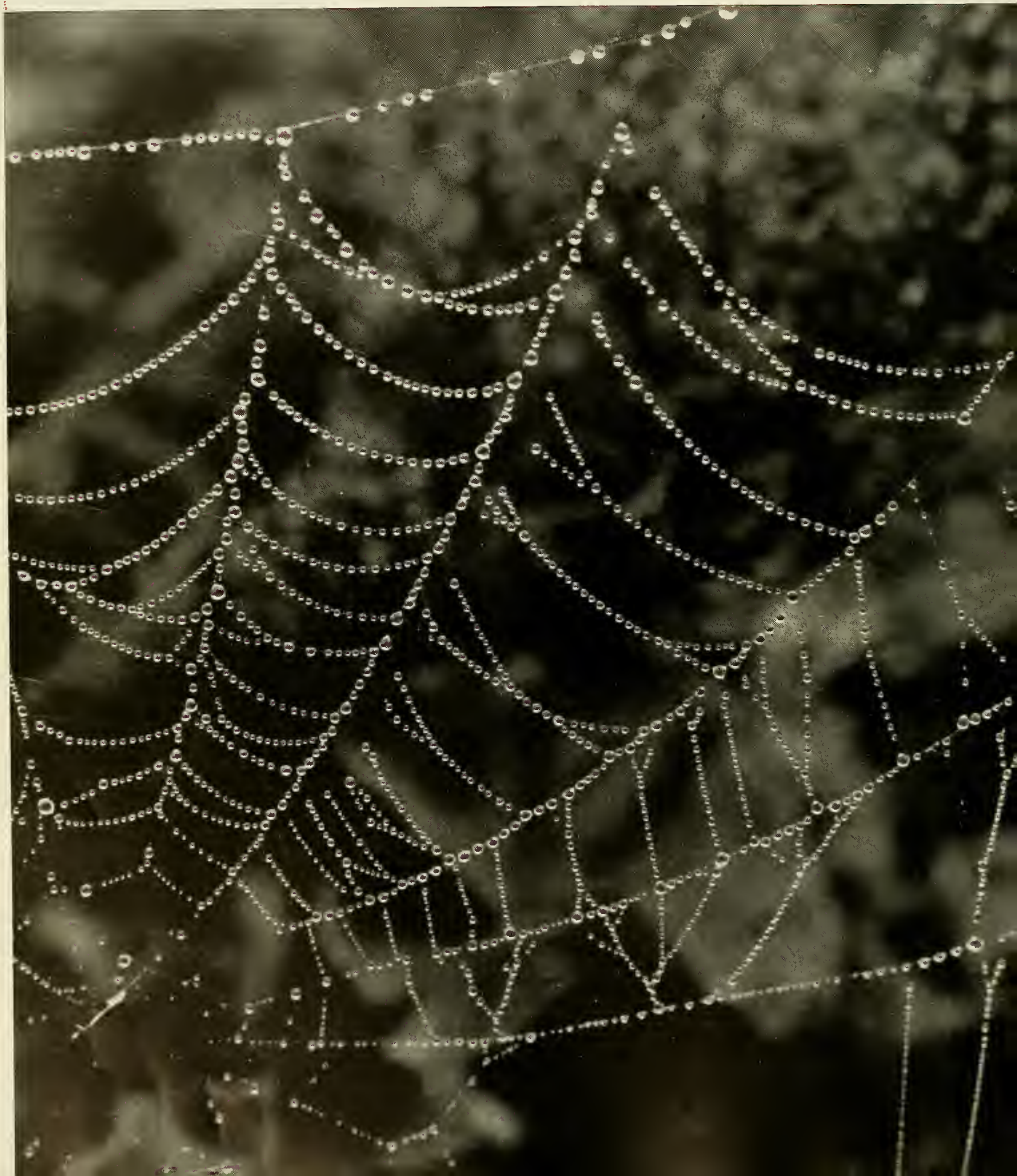
However, toward the end of August or the beginning of September, the butterflies begin to flock. Soon they can be seen—gold dots against a vast expanse of blue—winging their way to meet their fellows and preparing for the long journey south into a land they have never seen, guided by some unfathomable instinct. Silently fluttering high above the earth, they go in search of warmer climates. Where do they go? And why? Perhaps some day we shall know the answer to the mystery of the monarch butterfly.

In order to obtain sufficient information to answer the mystery of the migration of the monarchs, thousands of specimens must be tagged in as many localities as possible during the northward migration between the months of April and June and on the southward migration between August and October. It is hoped that some of the readers of this article will want to assist in the tagging and in the rearing experiments. If you want to take part in this project, address your letter to: The Royal Ontario Museum of Zoology and Palaeontology, 100 Queen's Park, Toronto 5, Ontario. Necessary labels and paper punch will be mailed to you at no cost. If enough people cooperate, we may some day be able to tell the complete story of this mysterious traveler.

Jewels of the Daw

▼ **Nature's Necklaces:** each gem a perfect sphere, each thread a silver strand

Josef Golowka photo from D



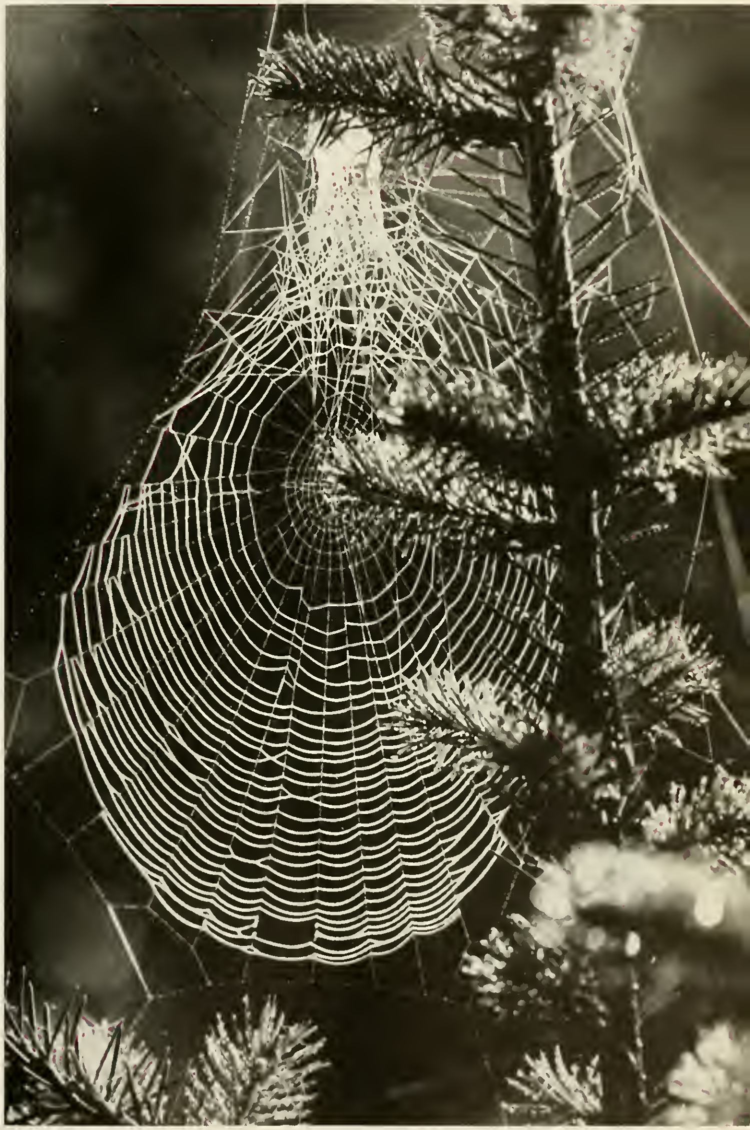
To the adventurous, distant shores may look greenest, but some of nature's brightest treasures are in your own back yard. Daybreak of any spring or summer's day may reveal acres of sparkling loveliness

By Hugh Spencer

IN quest of new sights and scenes, thousands of Americans take to the road each year to visit such famous places as Niagara Falls, Mammoth Cave, Yellowstone Park, or other spots of pictorial or historic interest. They spend hours, even days, pushing the pedal at 50 or 60 miles an hour to get somewhere and back over a week end. Yet, how many of them have really explored their own backyards and gardens? How many have ever arisen at dawn to take an early morning walk along a country lane or through a pasture lot, while a light fog curtained the land and the grass was wet with dew?

Such a trip can prove to be as much of a treat for the eyes as anything to be found in the faraway places and can be enjoyed at far less expenditure of time, effort, and money. At this hour of the day, the mist that hangs over the countryside conceals many an unsightly object and at the same time gives a charming, tapestry effect to trees along the distant fencerows, while dew on objects closer at hand sparkles in the morning light. It is an entirely different world from the one that may be seen at the same place in the glare of the midday sun.

The crowning beauty in this land of enchantment is found in the spider webs, sparkling with bright pearls of dew. They are everywhere along the way. We may be entranced by the lacelike patterns of the orb-webs, the "castles-in-the-air" of the filmy-dome spinners with their galaxy of twinkling dewdrops, the hammock webs that have caught a rich harvest of glittering jewels, the sheet webs of finest silk scattered by hundreds on



Hugh Spencer photo

▲ A CASTLE-IN-THE-AIR, with trellised turret the grass, or by others in a variety of shapes and sizes, including some that resemble miniature schooners with rigging illuminated like Christmas trees. We cannot collect nor can we duplicate these treasures that festoon the trees and shrubs, but the camera can capture some of their loveliness.

Dew is a product of certain weather conditions prevailing principally at night. Warm air has a tremendous capacity to absorb moisture. On a hot summer day, in apparent defiance of the law of gravity, tons of water, in the form of vapor, rise from the earth and are held in suspension by the air. In addition to that which is evaporated from the soil and from the surfaces of ponds, streams, and the ocean, other vast quantities transpire from the leaves of trees and other plants.

The capacity of the air to hold moisture is controlled by temperature. So when the mercury falls, the air must give up some of its load, with the result that dew is precipitated on surfaces cooler than the surrounding atmosphere. Leaves, grasses, spiderwebs, and other objects that radiate heat readily are the first to catch the dew. Dew does not fall, despite the common use of that expression. It condenses on whatever cool material is at hand. The moisture that gathers on the outside of a pitcher of icewater is an example of this phenomenon. Still, clear nights are best suited for the accumulation of dew. In the more humid areas of our country the precipitation of dew is a frequent occurrence.

Ancient superstition to the contrary notwithstanding, dew possesses no healing or curative properties not possessed by any distilled water. It is H_2O in its purest form unless contaminated by impurities from the surface on which it is precipitated. By itself the dewdrop is an interesting thing. Here we see an example of two great physical forces in opposition—gravity, which tends to draw it downward, and capillarity, which unites it with its support, resisting the pull of gravity. It refracts as well as reflects light, and in its gleaming surface an inverted and distorted image of the world around it is mirrored. Surface tension keeps it spherical. If it is slightly flattened, it becomes a lens with the power to magnify objects close at hand.

In a close-up examination of the beads of dew on the web, we marvel at the uniform spacing of the drops. It is almost as though they were of solid substance strung on a thread. Why do these drops of liquid not run down the strand to seek the lowest level? Even the strands that are straight up and down retain their beads at evenly spaced intervals.

One is tempted to explain this by pointing out that under the microscope the silk composing the spiral bands of the orb-spinning spiders is seen to be interspersed at fre-

Hugh Spencer photo

▲ **Mermaid's tresses.** In delicate beauty and diversity, the dew-laden webs of dawn are summer's counterpart of the snowflakes quent, uniformly separated intervals, by viscid globules. What would be more natural than that these globules should help to catch and hold the dew drops apart? But this is not the answer. The globules are so numerous that any single bead of dew would completely cover several of them. And if you will look at the illustrations, you will see that every other element of the web—the foundation lines, the radii, and even the neighboring lines not definitely associated with the web—are all rather evenly covered with dew beads, even though they do not have viscid globules. So, we shall simply have to say that the spacing is the result of surface tension until we can offer a more comprehensive explanation.

The orb-webs show by far the highest degree of development in the art of web spinning. Though we may dislike, or even fear the spinner, we cannot fail to admire the skill and ingenuity that created the beautiful net. Without blueprints and guided only by instinct, the spider lays out the frame, the spokes, and the spiral of the web with the precision of an architect and constructs it with the skill of an engineer. Each web is particularly adapted to the circumstances in which it is established.

Like Cinderella's coach, these jewels of the dawn are short-lived. With the first rays of sunshine, the thirsty air again drinks up the moisture, leaving only the naked webs waving in the wind, and the spell is broken for the day. Another dawn, however, may disclose new and different treasures. Any of them may be caught and preserved by the camera. The best photographs are obtained when the web can be seen against a dark background with the light from behind.

▲ Bright pearls of dew in a net of silk. Closer than our eyes can see, the camera discloses even greater beauty. Human artistry may tire itself in endless repetition, but here one stoops enthralled and knows it might well be said of Nature that naught can stale her infinite variety

BOUSSINGAULT—SCIENTIFIC ADVENTURER

Continued from page 225

Humboldt was attired in the same dress that men wore in the time of the Directoire: blue suit, yellow waistcoat, pants of a striped material, boots with different colored leathers ("the only ones like them in Paris in 1822") white cravat, and a shabby old black hat. Boussingault tells us that the great scientist saluted him with that delicate smile which was his and indicated by a gesture that he should go on with what he was doing. Humboldt went to the window with discretion and looked out on the roofs of Paris, turning his gray eyes only every once in a while to see how the hysterical lady was doing. She recovered and thrust the letter again into Boussingault's astonished hands.

"Read it, read it," she said, "there is nothing wrong with it."

"I found," said Boussingault, "four pages of very emotional and impassioned words."

After the woman left, he tried to explain the whole incident as best he could to the great German scientist. Humboldt at first, with the Mona Lisa smile that was natural to him, made a little sign of incredulity; but when Boussingault offered to show him the letter to reaffirm his innocence, Humboldt again gave that smile and said, "I must say, my dear young friend, that if the lady had really come to see you, you would have closed the door from all observers."

And that was the rather informal way that Boussingault met the great Alexander von Humboldt. Humboldt was much interested in the expedition; he gave Boussingault a letter of recommendation to General Bolivar and augmented this by giving him his instruments, a sextant, artificial horizon, prismatic compass, and a celestial Flamstead map. He did more; he taught young Jean Baptiste how to use the instruments. He did this with great difficulty, since his right arm was paralyzed from the rigors of his South American explorations, and "when he wanted to raise it, he had to lift it with his left."

At last they were ready, and now they were six. Jose-Maria Lanz was to be chief of the mission, "a very pleasant man, former officer in the Spanish Navy, and co-author of the standard work, *"Essai sur la Composition des Machines."* Docteur Désiré Roulin, physician, artist, and zoologist, was destined to leave a wonderful album of sketches from the expedition. Of Dr. Louis Bourdon, surgeon and entomologist, Boussingault said, "He had the manners of a speculator and made a fortune." Finally Justin Goudot was to be the botanist and preparator of natural history specimens. He was "very original, very clever, with a passion for plants, of which he made beautiful collections . . . He was a poet of nature, and the beauty of life impressed him very much; yet he could not speak about it, but could write with great charm about nature in his letters."

So, being ready, they were given a farewell dinner, which Humboldt attended. After this Boussingault embraced his mother, and on the 3rd of August, 1822, having eluded the police (for Louis XVII of France had an understanding with the King of Spain to block the revolutionists), they arrived by separate routes at an obscure dock in Antwerp, Belgium. There they boarded an American sailing ship, the "New York." And in the dark of night, with the police still in pursuit, they put off for their adventure. It was to be a memorable scientific journey.

Jean Baptiste Boussingault was only 20 years of age.

The story of this historic expedition will be concluded in the next issue of NATURAL HISTORY.

THE GREAT AMERICAN LITTERBUG

Continued from page 207

man whose conscience had been bothering him. The Park Superintendant hopes that even the cannon balls will come rolling back in due time.

In the last analysis, Park and Forest officials must dispense with formalities, roll up their shirtsleeves, and clean up the mess as best they can. Clean-up in Mount Rainier costs $150 in labor alone every Monday. Ugly names and obscenities are inflicted by pencil, lipstick, and knife on picnic tables, comfort stations, elevation markers, and signs. One blemish is the invitation for a hundred more. Rubbish attracts rubbish like a magnet. The lipstick epidemic on the Statue of Liberty a few years ago taxed not only the Park rangers' patience but also the American public's pocketbook—to the tune of thousands of dollars. Maybe a few neat signs with the old jingle, "Fools' names, like fools' faces, are always seen in public places," might produce results. In addition to the usual registers, the Pike National Forest has installed a "Whittling Log."

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With incorrigible vandals, the velvet scabbard is seen to hold a sword of steel. Pollution of the water supply in the Hyde Park Recreation Area outside Santa Fe, New Mexico, was so outrageous a few years ago that the area was temporarily closed. And several recreation areas in Indiana and Ohio have had to be permanently closed, the vandalism was so severe and constant. Really destructive individuals are simply given the old heave-ho. Park officials have phenomenal memories for faces. Take the case of the speedster who was told to leave one of our National Monuments and never to return. Fifteen years later, after a world war, the man came back. As he was entering the lodge, the Park Service official greeted him with, "I thought I told you never to come back!" Reacting like a ten-year-old caught in wrongdoing, the man hastily replied, "I'm going, I'm going."

The answer to all this? It is certainly not enough to say, "My record is clean—I always clean up after a picnic." You can lend a hand to our Park and Forest officials by speaking up when you see someone scattering litter or destroying something. "Excuse me, but you're not supposed to do that —and here's why. . ." A simple explanation may be all that's needed, though sometimes even stronger language may be necessary. But *do* exert your freedom to speak. And if this has no effect, call a ranger.

The hope that the American public will change its untidy and abusive habits is not entirely wishful thinking. The basis for this statement? A county park in eastern Pennsylvania which, instead of turning a park into a dump, reversed the process. The Upper Perkiomen Valley Park transformed two hideous dumps, which included everything from pig carcasses to automobile shells, into a positive haven for recreation. Its 425 acres of woods and lawn and 38-acre artificial lake accommodate as many as 30,000 visitors on a busy summer Sunday. And, after enjoying themselves thoroughly, the picnickers leave the park in immaculate condition. Not a single initial or obscenity is to be found in toilets or bathhouses. There is no such thing as the "morning after," so universal in other parks, even with such heavy use of a small area.

So let's put an end to it! Americans can learn not only to improve their outdoor manners but to take an actual pride in their recreation lands. They can learn to use and not abuse, to enjoy and not destroy. They can take to heart the forest-fire slogan, "This Is God's Country—Don't Make It Look Like Hell!"

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FROG-FOOTED DIVER with Aqualung exploring a sunken ship

The Screen

Authentic comments on films in the field of nature, geography, and exploration

Edited by ELIZABETH DOWNES

Undersea Films

VIVID shots of the undersea explorer and undersea life are shown in two short films "Danger Under the Sea" and "Rhythm on the Reef," recently released in this country by Universal-International. These pictures were directed and photographed by the French undersea explorer Jacques-Yves Cousteau and produced by Thomas Mead.

We think readers of NATURAL HISTORY will be interested in the comments of Dr. Roy Waldo Miner and Mr. Chris Olsen, who together pioneered in undersea exploration for the American Museum of Natural History. Dr. Miner, former Curator of Invertebrate Zoology, was associated with the American Museum for over 40 years. Mr. Olsen, who was also associated with the American Museum for many years, devised underwater photographic equipment and made paintings when he was actually under sea in order that museum habitat groups depicting this realm might be accurately executed.

As Dr. Miner points out, these two unusual motion pictures were made possible by the remarkable diving outfit and submarine camera invented by Captain Jacques-Yves Cousteau of the French Navy. "In 'Danger Under the Sea'," Dr. Miner says, "the divers, with their helmets, compressed air tanks strapped to their backs, and frog feet, swam down over 200 feet under water in the Mediterranean to visit sunken submarines, photograph them, and aid in salvaging them. Not much undersea life is shown in this film except that the steelwork of the wrecked submarines was covered over with mosslike growths of hydroids, bryozoa, and sea mosses, with a few fishes flitting here and there."

In Mr. Olsen's opinion, "'Danger Under the Sea' may well be compared with a modern version of Jules Vernes' dreams, and, to be sure, it would have delighted this grand author could he have beheld the achievements of a countryman three or four generations later. It is truly delightful to see the improved methods in undersea diving that have been developed within a short generation by Captain Cousteau and his companions of the French Navy."

"The Aqualung diving apparatus, perfected by Cousteau and used in filming this and other undersea pictures, is truly phenomenal, to say the least. In this film we see it used by the excellent swimmer Frederic Dumas, Cousteau's close diving companion, who is accredited with the almost unbelievable skin dive of 302 feet. The Aqualung and frog feet are a great improvement over the trailing airhose and the mechanical air pumps, which were the equipment we used to use. The film gives a remarkable demonstration of the fishlike appearance the human figure assumes with this new equipment. This becomes even more remarkable when we think what an awkward swimmer man really is.

"It is worthy of mention that this film was made during the perilous period of 1942-43 during the German Occupation of France and under the very noses of the Germans without being detected. One criticism that can be offered, although a minor one, is the use of the word 'danger' in the title. Undersea divers prefer to refrain from the use of this expression in connection with their operations. The picture runs for 16½ minutes and is very well done."

"It is in the second film, 'Rhythm on the Reef'," writes Dr. Miner, "that the undersea cameras really made photographic records of the submerged inhabitants of the ocean. The tropical waters around the Cape Verde Islands off the West African coast are so transparent that even at depths of 200 feet or more photography was possible. In viewing this film, the observer hardly realizes that he himself is not swimming in company with the weird sea divers, equipped with the Aqualungs, in the twilight oceanic depths. Propelled by the frog feet, the divers glide among great schools of tropical fishes. It was interesting to note that crowded throngs of dolphins were scarcely disturbed by the diver swimming among them; apparently they regarded him as a fish like themselves. Each species of fish kept together, swimming in its own particular school as the diver and his companions joined first one and then another. Besides the swiftly-moving, streamlined dolphins, there were various species of wrasses, striped grunts, yellowtails, and herrings, all conservatively keeping together in each case, and all heading in the same direction through some multiple leader-like instinct, simultaneously rising and falling or wheeling to right and left, like soldiers on parade. Spadefishes, triggerfish with their vertical, oddly-shaped and queerly-marked flattened bodies, butterfly fishes, tangs or doctorfish, each with a lancet-like, keenly-tipped prong arming the narrow peduncle of its tail, glided calmly in successive schools through the watery depths, regardless of their human visitors. Under a coral cavern, there peered forth the jointed form of the spiny lobster *(Panulirus)*, while near by, odd-shaped toadfish poked their ugly bodies nuzzling through the mud for the shellfish that formed their food. Two or three sea turtles swam near a diver, who darted forward, seizing the shell of the turtle near the back of the neck and causing him, in wild alarm, to swim toward the surface, carrying his human visitor along with him.

"The general impression is of a great abundance of sea life living in these deep waters here being invaded by helmeted human visitors. It was remarkable to note the clearness with which the inhabitants of the undersea could be photographed at these depths by the submarine motion picture cameras of the divers.

"This film was much more interesting to the undersea naturalist than the other one, which photographed the divers among the submarines.

"It is a striking film, well worth seeing."

Mr. Olsen was particularly impressed with the sound rhythm and the splendid black-and-white photography of "Rhythm on the Reef" but hopes that some day color photography will be perfected in

A spectacular scene from the "Valley of the Eagles," showing a herd of reindeer stampeding down a snow-covered slope

Eagles instead of rifles are used for hunting

A Lapland hunting party mounted on reindeer with their hunting eagles perched on their shoulders

order that full justice may be done the fishes and the reefs. "The sounds on the drums by Kenny Clark," Mr. Olsen remarks, "which rhythmically accompanied the slaps and kicks of a caught fish on the deck of the boat, make an intriguing opening to the picture. Both of these films are truly of educational value to the serious and interested observer, and they have kept clear of any commercial glamorization. Let's have more pictures like these!"

"Rhythm on the Reef" runs for nine minutes.

Forest Fires and Lapps

TWO full-length feature films, "Smoke Jumpers" and "The Valley of the Eagles," while they have melodramatic plots, may attract the attention of persons interested in natural history.

"Smoke Jumpers," starring Richard Widmark, and released by 20th Century-Fox, is based on the fire control activities of the U. S. Forest Service. The story is about the responsibility of a squad foreman for the lives of the men he leads, and the presentation is definitely fictionalized.

There are authentic forest scenes from air and ground around the U. S. Forest Service Station at Missoula, Montana, combined with studio shots for the actual fire fighting. A well-known conservationist says, "This film demonstrates in graphic fashion the terrible destructiveness of forest fires and the need for constant watchfulness lest fires get out of control. Although lightning started the fires shown in this film, a single careless cigarette can equal a bolt of lightning." This picture, which is in technicolor, was produced by Samuel Engel and directed by Joseph M. Newman.

We have asked a celebrated ornithologist, who is familiar with the bird life and geography of Scandinavia and has visited the people of Lapland, to comment on "The Valley of the Eagles":

"This picture, which was filmed in Scandinavia, is replete with all the time-worn and overworked melodrama of moviedom. A confused story of the theft of a Nobel prize winner's invention by the neglected wife of the genius and his laboratory assistant ends familiarly in the demise of the culprits in an avalanche and the immediate popping up of the right woman. The thread of the narrative is not in the least helped by the diction of most of the participants.

"Scenically, there is much to be said for the parts of the film taken in Lapland, where the winter countryside, the Lapp people, and their reindeer are strikingly portrayed. For nature lovers, the climax is reached in an extraordinary scene of trained golden eagles. The eagles are released by Lapp falconers against a large group of wolves endangering snowbound travelers. The birds, singly or in pairs, attack the supposedly hungry and ferocious mammals without hesitation, actually fastening with their talons and pinning down some of the wolves so that they can be killed with lances, and putting the others to flight."

"The Valley of the Eagles" is a Lippert Pictures presentation and was written and directed by Terence Young.

"Strange World"

DISREGARDING its lurid plot, the feature film "Strange World" portrays some scenes and situations in the South American hinterland that warrant comment in this column.

"Except for occasional views of well-known Andean ruins and for fleeting glimpses of Amazonian villages and natives," says a well-known anthropologist, "the portrayal of the Indians in this film could scarcely be more inept, inaccurate, or ridiculous."

Another seasoned South American explorer, experienced with the techniques of the trail, says, "The hero and the friendly Indian set out on a canoe journey which lasts at least long enough for the hero to contract and recover from an attack of fever; but not a scrap of food, equipment, medicines, ammunition, or gear of any sort is carried, and the canoe is quite empty. When the hero finds his heroine, with beautifully waved hair and snowy-white garments after a ten-year period in Indian hands, he exclaims, 'It's impossible.' That, I think, sums up my opinions perfectly, though perhaps I would have said, 'Ridiculous'."

"A hodgepodge of not too well-photographed spots," comments a naturalist familiar with the geography, plant, and animal life of South America. "Most of the bird, plant, and animal life was shot in a zoological or tropical botanical garden, and practically none of it is realistic. For example, the boa constrictors and the anacondas are obviously zoo specimens, and their names are mixed in the film, to say nothing of their actions."

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LETTERS

Continued from page 193

timber last until the young trees are big enough for saw timber? Is the $5 per thousand board feet received by the Forest Service in line with the $125 or more per thousand board feet paid by the ultimate consumer?

I am interested in our lumber reserves and would like to know where they are. It would be unfortunate to have our future lumber reserves left devoid of marketable lumber like some of the forests of eastern Pennsylvania.

A. A. Cassell
Allentown, Penna.

Sirs:

. . . We could outline numerous reasons and go to great length to describe our feelings if it were necessary but . . . the American people would have only one answer . . . "Yes, certainly, we want our wonderful forests preserved."

Mrs. and Mr. Robert L. Goggin
Kansas City, Mo.

Sirs:

. . . As one who loves unspoiled wilderness and feels that the spiritual and esthetic values of the "far places" far transcend any short-lived commercial gain, I believe that as little cutting of timber as possible should be done in such areas. . .

Mrs. Robert Dagg Willison
Cincinnati, Ohio

Sirs:

. . . I am glad that you have brought this situation to the attention of the public, and I hope that you will follow it up further. . .

Daniel Smiley, Jr.
Mohonk Lake, N.Y.

Sirs:

. . . May I add my few words of protest against the apparent needless and greedy cutting in our National Forests, particularly in the El Dorado and Tahoe Forests of California. If any of our giant friends are to be left standing, immediate action appears necessary. . .

Hester Weymouth Coan

Sirs:

I care very much indeed about what happens to our National Forests and am convinced that they should be preserved at all costs. . .

Personal enjoyment of the beauty of our Forest resources is not enough to assure their preservation. An understanding love and devotion to their ecological advantages is an attitude that remains to be developed by a far greater proportion of our citizens. . . The dismaying fact is that the public at large is only too willing to support a terrifying extravagance, which bleeds our resources. When the public is ready to give up its enormous Sunday papers, I will then, should I live so long, be ready to think they are concerned with conserving the pulp wood that is the source of those papers.

Austin Purves
Litchfield, Conn.

Sirs:

. . . If an individual can be helpful in this cause, I should be very glad to write letters advocating whatever stand the American Museum takes on the matter.

(Miss) Marion McMaster
Philadelphia, Penna.

Sirs:

. . . Please count me in your list of those who really would like to see a substantial area of the National Forests protected from all cutting.

Pierce H. Beij
Ashland, N.H.

Sirs:

. . . I experienced great satisfaction upon finding such articles as "Is There Time to Save the Eskimo?" and "Cut Or Let Grow" in Natural History. . . I appreciate your efforts to bring these things to the minds of our citizens. . .

Joel Connolly
Wooster, Ohio

U. S. Forest Service Plans Timber Review

Since the publication in Natural History Magazine of the article "Cut or Let Grow," the U. S. Forest Service has announced their intention of conducting an extensive study of the timber resources of the United States. "The review," said Lyle F. Watts, Forest Service Chief, "will take at least two years to complete. It will bring up to date the information on timber resources, reanalyze prospective requirements, supplies, and growth of timber, appraise today's timber-conservation programs, and chart a course for American forestry. Advice in planning the project and help in determining the facts of the forest situation will be sought from state and private forestry agencies, the wood industry, and conservation organizations.

Against Hunting in Parks

Sirs:

Here is my "oar" in the "Hunting in National Parks controversy". . .

As a reformed hunter I think I know the hunter-fisherman type of mind. It is characterized by extreme selfishness . . . the hunting clique . . . is powerful. But I think every person who values America's heritage of wildlife should hop to it and get busy. Count me in. How can I best make my protest felt?

It would be one of the great tragedies of American wildlife to permit hunting in the National Parks. It would destroy the purposes of the Parks. Any arguments in its favor are completely specious, because everybody knows that the purpose of hunting is destruction, while the purpose of the National Parks is preservation.

Charles B. Roth
Arvada, Colo.

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In response to Natural History Magazine's article "Do You Want Hunting in National Parks?", two seven-year-old children wrote to their Senator and received the following letter from the Honorable Herbert Lehman:

Dear Maureen and Eric:

I thank each of you for your very good letters. As you do, I think that the animals in our National Parks should have every possible protection. I sent your letters to the National Park Service so I could find out exactly what was being done under existing law about preserving our deer.

I have now heard from the National Park Service, and they have told me several interesting things which I want to tell you. The Park Service tries to keep alive as many different kinds of animals as possible. It is not very difficult to keep the cottontail rabbit, the field sparrow, and the channel catfish alive. These animals take very good care of themselves. But the Park Service has to be very concerned about the Sierra bighorn, the grizzly bear, the buffalo, the salmon, and many other species. Some of these animals need a good deal of help. However, most of the animals in the National Parks only ask that we do not meddle with their ways, for we lack both the knowledge and means to "improve" their ways of life.

Sometimes, however, natural conditions and relationships between the various animals in the Parks are disturbed. Then some of the animals must be helped to survive. Some kinds of animals dwindle and disappear from our Parks, while others embarrass us by increasing to several times the normal number. The causes for these increases and decreases are usually complex, and sometimes we

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cannot find out just why things are as they are. However, the National Park Service does try to help all the animals get their rightful share of the good things in the Park.

They have assured me that they are very sorry when any harm comes to any animal in the Parks. They further say that they permit interference with the animals only when some types of animals become so numerous that they threaten the very existence of some other kinds of animals. However, no hunting is allowed in National Parks. There have been times when certain animals such as deer and elk have become so over-abundant as to destroy their own food supply. When this happens, the Park Service has to take certain corrective steps. Artificial feeding as a long-term measure has proven impossible. The only successful solution has been to remove enough animals so that the natural food supply can grow again.

Now this is a very long letter, but I did want to assure you that under the existing laws, the National Park Service is working very hard to see that all the animals in our National Parks have a fair chance to live. I do hope when you grow up that you will go to see our various National Parks and that you find there the deer you love and all the other animals too. . .

HERBERT LEHMAN

★ ★ ★

SIRS:

I am writing to tell you how much we all enjoy NATURAL HISTORY Magazine. . . We want to keep the magazines and have them bound into a book. We especially enjoy the articles and pictures on the American Indians. We are all very much interested in these people. So, again, thank you for the pleasure we have got from your grand Magazine!

MRS. T. BARRY, AND FAMILY

Lanes, England

SIRS:

I enjoy your Magazine very much and read each issue thoroughly. Your photographs are excellent and the articles very informative. More than once they have given me added incentive to go visit some places here in the Southwest.

PAUL BENIOFF

Berkeley, Calif.

SIRS:

I should like to take this opportunity also to speak my great appreciation and enjoyment of the exceptionally fine work being done by the editors of NATURAL HISTORY Magazine, which I think is the finest product of its kind. . . All in all, each copy of this publication is a door opening into often new and usually wonderful worlds of enjoyable experience. The text, the photography, and the layout are such as to make each copy an achievement of superior merit.

BARBARA ELINORE HAYDEN

Concord, N.H.

A CAMERA HUNT FOR THE PURPLE HERON

Continued from page 211

rushes, which seemed to shoot up before the lens. It became a race with time. Could I afford to wait till my friends came back, or should I hoist my flag of distress? When at last the water streamed into my waders and I felt like a man in quicksand, I heard my friends approaching. My first thoughts were for the safety of my plates and films and to save my camera from being submerged. After that, with the united efforts of my friends, I was extricated from the sucking mud.

About a month later we again went to the colony of the Purple Heron. Owing to the abnormal height of the water, we could no longer reach the nests and were unable to take photographs or erect a blind. Through field glasses, we saw that the young, except for their coloring, bore a striking resemblance to those of the Blue Heron, and as is the case with other heron-like birds, they were fed by regurgitation. In the very early stages, the young seize the parent's bill, and after some tugging they take the regurgitated food directly from it. Later a similar stimulation by the young causes the parents to disgorge food into the nest. This whole procedure is accompanied by violent wing flapping.

Observing this rare and beautiful bird was a most rewarding experience. So if, sometime, you cross the Atlantic to "do Europe," don't forget to save a couple of days to visit the famous reservations and nesting places of the Purple Heron in Holland, where many other interesting birds can also be seen. It will prove to be time well spent.

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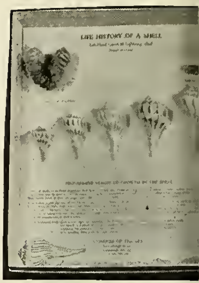

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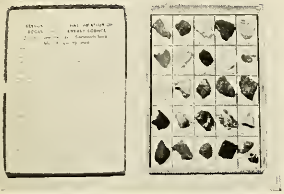

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LETTERS

Pet Butterfly

Sirs:

Anyone who thinks he is familiar with all the unusual kinds of pets may find interest in the remarkable friendship that grew up between Mr. Thomas Emery of Oyster Bay, Long Island, and a Red Admiral butterfly (*Vanessa atalanta*).

Mr. Emery was getting his breakfast on a lovely summer morning when this shining butterfly stopped on his table and sampled a drop of honey on his plate. Mr. Emery remained still. Very gently he moved his hand toward the butterfly and waited. After having a good meal, the butterfly perched on his hand and stayed there for a while. Thus Mr. Emery acquired his strange pet.

Every morning at breakfast, the Red Admiral would show up and come directly to Mr. Emery. It would perch on his brow or shoulder and look for more honey. Finding the honey, the butterfly would unroll its slim dark tongue and suck with great speed. Then, after resting on Mr. Emery's finger, it would fly away.

But that was not all. Every afternoon around three o'clock, Mr. Emery would go into his garden to enjoy his flowers and watch the birds. At that time, the Red Admiral would be waiting for him. It would flutter around for a time, and then Mr. Emery would lift his hand, and the butterfly would perch on his finger and take a little walk with its friend. There was no prospect of honey at this time.

Then a mishap occurred that nearly broke up the comradeship. Mr. Emery was dressed in white for tennis one day when he stopped at the bushes where the Red Admiral customarily waited for him. The butterfly came fluttering out as usual, but instead of perching, it flew away and disappeared. The next day, when Mr. Emery was dressed in gray, the butterfly returned and was as friendly as before. The butterfly hopped onto his finger and advanced gently with its little body quivering. But 24 hours later, the Red Admiral flew away in fright. This time Mr. Emery noticed that in both cases when the butterfly refused to come to him, he had been dressed in white. So, for weeks Mr. Emery avoided white clothing, and the happy relationship was re-established. Each day meant honey in the morning and walks in the garden in the afternoon.

Then one day, Mr. Emery had to leave on a short trip, and the butterfly was never seen again.

Friends found the butterfly so interesting that a number of photographs were taken. I offer this one in the thought that readers of Natural History Magazine may be inspired to duplicate Mr. Emery's patience and learn what remarkable confidence can be expected of a creature that has been given no reason to fear.

Mrs. R. L. Grandjouan

Oyster Bay, L.I., N.Y.

Boussingault added Iodine

Sirs:

In your May 1952 number it is stated that ". . . No one now remembers the name of Boussingault—unless one is a student of the history of science. His chemistry papers gather dust; time has passed them by." However, at least one observation of Boussingault's is brought daily to the attention of all housewives, when they see or buy iodized salt.

On page 271 of my book *Life—Its Nature and Origin*, it is stated: "In 1833 Boussingault suggested the addition of iodine to cooking salt, since he observed in South America that goiter was prevalent where iodine was lacking."

In the 4th edition of my *Colloid Chemistry*, the following was stated: "In 1812 Courtois discovered iodine, and in 1819 Dr. Coindet of Geneva tried it as a remedy for goiter. He walked into LeRoyer's Pharmacy there, and asked J. B. A. Dumas (then only 18 years of age) to determine for him if sponge, especially burnt sponge, contained iodine. When Dumas reported that it did, Dr. Coindet no longer hesitated to consider iodine a specific against goiter . . ." The use of burnt sponge was common from the latter part of the thirteenth century and was probably based on much earlier folklore.

In justice to Boussingault, I trust that you will publish this brief statement.

Jerome Alexander
Honorary Secretary, American Section, Société de Chimie Industrielle

New York, N. Y.

Bird's-eye View

Sirs:

In your April issue, Tom McHugh raises a point concerning the water ouzel when he states that "under water the Dipper keeps its eyes open just as any man swimming below the surface." This may or may not be the whole story, and the probabilities are against such a simple explanation.

Anyone who has tried to see underwater while swimming knows how blurred everything looks to eyes adapted to vision in the air. A fish, on the other hand, does not see well out of water. In general, the eyes of birds are correct for aerial vision. Penguins are an exception. Their eyes are excellent for underwater pursuit of prey but are extremely nearsighted in the air. But in three groups of birds, special devices allowing accurate vision both in air and water are now known. The dipper still remains a mystery and offers a good problem for some enterprising observer in the West.

The cormorants have very soft lenses and extraordinarily strong muscles controlling them. Thus they can change the shape of the lens enough to permit vision in either medium. The alteration, measured in terms an eye-specialist would apply, is from 40 to 50 diopters, whereas only a few diopters are possible in other birds.

The diving ducks, auks, and loons make use of another system. In these the third eyelid (the nictitating membrane), has a transparent, lenslike window at its center, with sufficiently highly refracting material to act as a water lens when these birds dive.

Kingfishers have a third solution to the same problem. If interpretations are correctly drawn, these birds have two different types of vision built into the same eye. The eye is slightly larger in equatorial diameter than in polar diameter, and it has an egg-shaped lens, held with its long axis pointed more or less parallel to the bird's beak. Each eye has two foveas (areas of special sensitivity on the retina), instead of one. While in air, hovering over a pond or stream, the kingfisher watches its prospective victim through one eye, sidewise through the lens and with the image thrown on the central one of those two foveas. When the bird dives, it looks through the long axis of the lens, and the image falls on the temporal fovea. Under the water the eyes are both aimed at the same point, and the bird looks directly forward along the beak.

Whether the eye of the water ouzel corresponds to one of these three types or constitutes an entirely different fourth is unknown. Perhaps some other reader of Tom McHugh's article will be stimulated to find out.

LORUS J. and MARGERY J. MILNE

University of New Hampshire,
Durham, N. H.

Fifty-portion "Asparagus"

SIRS:

The young flowering stalk of the yucca, *Yucca whipplei* (right) is like a huge reddish green asparagus, but few persons realize that it can be eaten like asparagus. The Indians of southern California are known to have harvested yucca sprouts for eating, and this year I, too, had the pleasure of trying this unusual "vegetable." The young stalk is soft and easily broken. The pale green interior smells like a cross between watermelon and cucumber and is tasty raw. Some I sliced and prepared like asparagus, topping them with melted butter. Prepared thus they are quite palatable, and one yucca will serve about fifty people!

The deer is the only animal able to avoid the spinous base of the yucca to eat the soft stalk. In some areas, a considerable fraction of the yucca crop is destroyed in this way by deer.

GUSTAV ALBRECHT.

Altadena, Calif.

Vampire Priority

SIRS:

It has been with true interest that I have seen in the February number of your splendid magazine the article on vampire bats. . . . I find there the statement, quite frequently repeated in books on natural history, that "the scientist who first actually witnessed the vampire bat drawing blood from an animal was Charles Darwin. This is not exactly true. . . . Many years before Darwin, indeed in 1802, the Spanish naturalist Felix de Azara discovered the species in Paraguay and gave an excellent description of the animal and of its behavior. . . . And the fact that the vampire bat draws its victim's blood, not by sucking it, but by taking it up with the tongue ("lamiendo," or by lapping) was suggested by Azara in his account. So Dr. L. H. Dunn in 1932 was not really the first to point this out. Even in 1925 when I described the feeding method of the vampire in *Historia Natural*: *La vida de los animales, de las plantas y de la tierra,* I derived all the facts from the late J. A. Wolffsohn, a British zoologist who had been a resident for many years in Chile and had gained the information through personal experience.

Please do not see in this any intent to criticize. . . . In fact, I must congratulate you for the excellent educational work you are carrying out through NATURAL HISTORY, every number of which seems to surpass the preceding one, both in scientific interest and in artistic beauty. Your articles on conservation and the disappearance of primitive peoples are specially worthy of praise by every lover of nature, either scientist or layman.

ANGEL CABRERA

La Plata, Argentina

Reprints of Articles

SIRS:

In February, you published in NATURAL HISTORY Magazine an article entitled "Who Thought of it First?" by Benjamin Melnitsky. I have been wondering whether reprints of this article are available in fairly substantial quantities (300 to 500 copies). If not, could we reprint the article?

In operating a suggestion system for employees of the Bausch and Lomb Optical Co., we frequently receive the same suggestion from more than one person. When we inform the last suggester that his idea has already been submitted, he is often quite surprised that his "brain child" was not originally his. The article to which I refer, convincingly points out how many identical ideas have been thought of by many persons, sometimes simultaneously. I believe that reprints of this article would help us to get folks to

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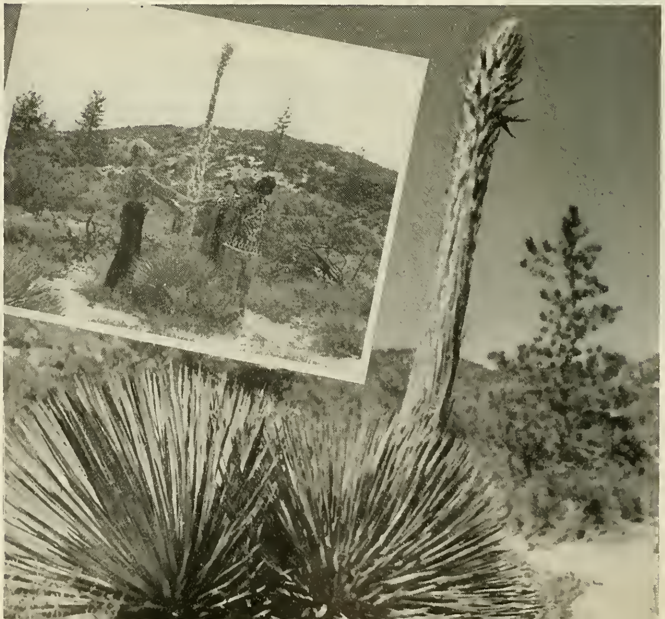

NATURAL HISTORY

The Magazine of the American Museum of Natural History

Alexander M. White, President
Wayne M. Faunce, Assistant Director
In charge of Publications
Albert E. Parr, Director

VOLUME LXI—No. 6
JUNE, 1952

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You will find Natural History Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

Photographers in Lassen Volcanic National Park, California, unfailingly converge in late afternoon at Manzanita Lake for the view of 10,453 foot Lassen Peak, the only recently active volcano in continental United States. Its modern series of eruptions began in 1914 and continued at intervals until 1921. The Devastated Area and new lava flows today remain prime exhibits of popular and scientific interest, but by far the greater part of the Park repeats the tranquil beauty of this month's cover, made by Hubert A. Lowman on a shutter-bug's dream of a late summer day.

Lassen is the southernmost major peak in the Cascade Range, a chain of volcanoes including such wonderful old peaks as Shasta, Hood, St. Helens, Rainier, Baker, and many more. These other Cascade peaks are not necessarily dead. St. Helens has certainly been active possibly within the last few hundred years. Steam commonly rises from Rainier's crater. It can therefore be conjectured that not only Lassen Peak but others in the range might someday erupt again.

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BURGLAR IN THE TREETOPS

- - - - - - - by George Heinold

Henry Holt and Company, $3.00
242 pp., 16 drawings

WHILE contriving to make *Burglar in the Treetops* entertaining and humorous, chief of police George Heinold succeeded in producing a most instructive volume on wildlife. He centered his attention on a few of the most outstanding animals of North America and brings them to life in a most realistic manner.

Few people, even in a lifetime, have had so many interesting experiences with the creatures of the field and stream or had the opportunity to observe their habits so closely.

His anecdotes are well presented, based on actual experiences, and are liberally interspersed with constructive information on life histories. One of his many amusing stories tells of a terrified taxpayer who reported a monstrous serpent swimming in her lake. Some ten minutes later Mr. Heinold saw something that made his eyes bulge—a long, sinuous, dark body winding through the water, with sections showing above the water about eight or nine feet apart. When the monster lashed about and set course in Mr. Heinold's direction the woman screamed. The "serpent" had an explanation. Five playful otters swimming in single file.

The title is perhaps somewhat misleading, since it is intended to apply only to the raccoon in the opening chapter. Animals such as the deer and otter live on the ground or in the water and do not climb trees.

The illustrations are rather poorly executed. However, they are intended more as a decorative feature than as characteristic portraits of the animals themselves.

Burglar in the Treetops is a worthy contribution to our knowledge on the life histories of North American wildlife. The naturalist, nature lover, outdoorsman, and hunter will find it a delightful book to read as will most city folk.

George Heinold was born on a small farm in Madison, Connecticut, and has known the woods since childhood. He has been a trapper, fur buyer, lumberman, commercial fisherman, and guide. He is now assistant chief of police of Madison. GEORGE G. GOODWIN

PEOPLE OF THE DEER

- - - - - - - - - - by Farley Mowat

Little, Brown & Co., $4.00, 344 pp.

WHEN any well-written book on a subject close to a reviewer's interests and experiences arouses enthusiasm, it is difficult to be impartial and to judge its value and interest for the average reader. In this instance, I believe my personal response can be trusted; that we have here a superbly-written document with wide appeal for any audience, and meat for those who seek knowledge of Eskimo ways. The author, with unusual understanding and sympathy, tells the tragic story of a little-known group, the Ihalmiut, one division of the so-called Caribou Eskimos. Living in the Barren Grounds west of Hudson Bay, these people depended for existence on a cultural adaptation to the annual migrations of great caribou herds. The tragedy lies in what happened as their culture was disrupted by contact with our civilization and the herds were reduced by commercial killing.

Perhaps never has the virtual extinction of a native tribe been described so graphically. When first visited in 1894, the author says that about 2000 people were living successfully under conditions that we would think impossible. Today, perhaps, 20 are left. Mr. Mowat did not go among them merely to get material for a book. After a short visit in 1947, he returned the next year with one companion to learn their language and their

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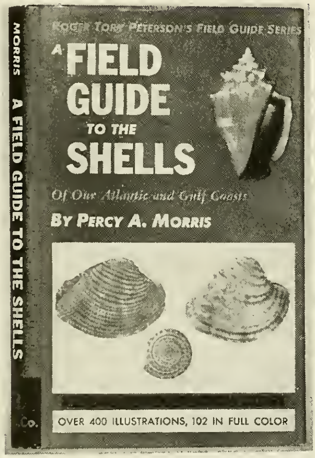
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ways. One has to know only a little of the region to realize how much he has omitted of the disagreeable aspects of his own stay in the land. One finds no such comment as that made by Knud Rasmussen after meeting some northern members of the same tribe, that he preferred not to share their dwellings for they were "so uncleanly in their habits that it would have been difficult to accommodate ourselves to such conditions." This from a man who knew Eskimos well and enjoyed their food and life. Mowat, in contrast, saw beyond such conditions and learned to respect the people who could survive in unheated snow igloos at 60 and 70 degrees below zero, at times with no fuel available to thaw or cook their food. His respect for what he found prompted this story of their passing, written with the hope that his warning will be heeded before more of the northern natives follow the *People of the Deer* to oblivion.

JUNIUS B. BIRD

MODERN GARDENING

- - - - - - - - - - by P. D. Pirone

Simon and Schuster, $3.50
371 pp.

THE book is described as "a complete guide to the agricultural uses of modern chemistry's miracle drugs," and all the new insecticides, fungicides, and herbicides are discussed. In the first chapter, the soil and elements necessary for plant growth receive attention. There are a few caustic remarks about some unnamed proponents of the "new" organic agriculture methods, which are probably not entirely undeserved. But these proponents in turn might criticize the otherwise excellent chapter dealing with foliage feeding (spraying chemical fertilizers on the leaves), on the grounds that it is still in the experimental stage. The first chapter ends with a table of plant nutrients (fertilizers), giving the trade name, nutrient content, manufacturer, and address.

It is only natural that the fundamentals of planting, such as soil preparation, should be discussed, and the chapters on herbicides and insecticides are enlightening. Each is followed by tables listing the products and their uses. Other tables deal with diseases of trees, shrubs and flowers, fungicides, combination sprays and dusts, and a vegetable disease control chart. The charts have been carefully prepared and will prove of great value to the gardener who wants to know what to use, how to use it, and where to get it.

The second part of the book deals with answers to 500 commonly asked questions, and the field is covered in a very satisfactory manner.

The conservationist might criticize the recommendations of DDT, and some of the other new chemicals because they are not selective killers and may kill off many more beneficial insects than they do harmful ones. Some are extremely poisonous and dangerous to handle, but they do have a place in garden pest control. Almost all insecticides have some dangerous qualities, but when properly used by those who know how to use them they are quite safe.

I recommend the book to anyone interested in plants and their care and congratulate the author on a well-integrated product.

C. H. CURRAN

CARAVAN

- - - - - - by Carleton S. Coon

Henry Holt and Co., $5.00
376 pp., 43 illus.

PROFESSOR COON has written an extraordinary book, which should be read by anyone whose occupation, enthusiasm, or humanistic sense requires an enrichment in this geographic area. For Americans, the Middle East has only recently asserted itself: in the oil situation in Iran, the oil companies in Arabia, the Suez Canal crisis, the new state of Israel, the nationalistic trends in Morocco and Tunis, Kashmir, etc. But the problems are ancient, as Professor Coon demonstrates in the early chapters of his book. They are only brought into special focus in this era of internationalism, when the region from Morocco to Pakistan—the homeland of Islam—is destined to play a paramount role in the postwar world's effort to balance economic need and political ambition peacefully. The need for an understanding treatment of the peoples of the Middle East is obvious, yet this area represents a bewildering complex of peoples, languages, religions, and cultures even to the experienced student. A book like this one happily shows the reader that the facets making up this complexity fall readily into a logical and understandable order. The relation of religion to life, bazaar to home, tent to walled garden, sect to doctrine, history to tradition, people to geography is set forth clearly and colorfully by the author, who draws on his vast experience among the peoples of Africa and Asia.

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The "mosaic" picture of carefully integrated pieces of Middle Eastern ethnology, history, geography, and politics, which is the aim of the book, is sharply brought into focus by the wealth of factual data filling the pages. The author states in the first chapter ". . . it is essential that Americans have a true, clear, and sympathetic understanding of Middle Eastern peoples and their problems." Certainly *Caravan* contributes a great deal toward that understanding.

WALTER A. FAIRSERVIS, JR.

BROWN MEN AND RED SAND

- - - - - - by Charles P. Mountford

Frederick A. Praeger, $4.50
184 pp., 65 illus.

THE Australian aborigines are an interesting people for many reasons, not the least of which is their remarkable adaptation to the central desert area, an environment in which Europeans would perish if unsupported by aid from outside. Yet these natives manage to lead happy and relatively secure lives. Anthropologically they have been noteworthy for the special development of certain social complexities that stand out in dramatic contrast to the extreme simplicity of their material culture.

Mr. Mountford who has known these people for many years has written a charmingly sympathetic account of them

Continued on page 285

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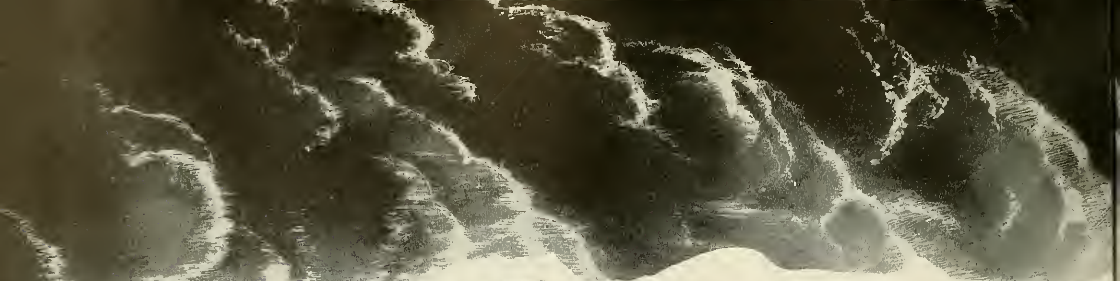


Brandywine Valley Association photo

▲ A TYPICAL RUBBISH HEAP on the Brandywine only four years ago

▲ IN MANY parts of the valle there was deep erosion in field abandoned because of diminishing yields. Rapid run-off wa robbing the valley of thousand of tons of topsoil

Brandywine Valley Association photo

◀ WITH NATURAL flood control weakened, the waters frequently overflowed the banks of the river. The repair bill for this plant alone in the flood of August, 1942, was $350,000

▶ IN 1940, this farm ha gullies six to eight fee deep and couldn't pa taxes. In 1948, it took i $51,000

the Valley that Smiled Again

The second battle of the Brandywine turned the valley green and tested a plan of home-grown conservation that has become a model for the nation

By Terry Ross

COUNTLESS books, articles, and speeches have taken up the theme that we are spending our natural resources far faster than they are being restored. It has been pointed out, for example, that *over 65 per cent of all new wealth created in this country has its origin in farm or forest;* that one-fifth of our *farmland* is already lost, one-third badly damaged, and one-third in danger of being swept away; that our *forests* are dwindling so rapidly that even if good practices were begun at once, it would take 45 years to catch up with the rate of depletion.

Many thoughtful people have therefore raised the question: Is America—the hope of civilized peoples everywhere—on the road to becoming a second-class power?

"A sound and effective conservation program," says a recent report to President Truman, "will prove, perhaps, the most powerful weapon in securing the salvation of our civilization."

Viewed in this light, what has been called "The Second Battle of

Brandywine Valley Association photo

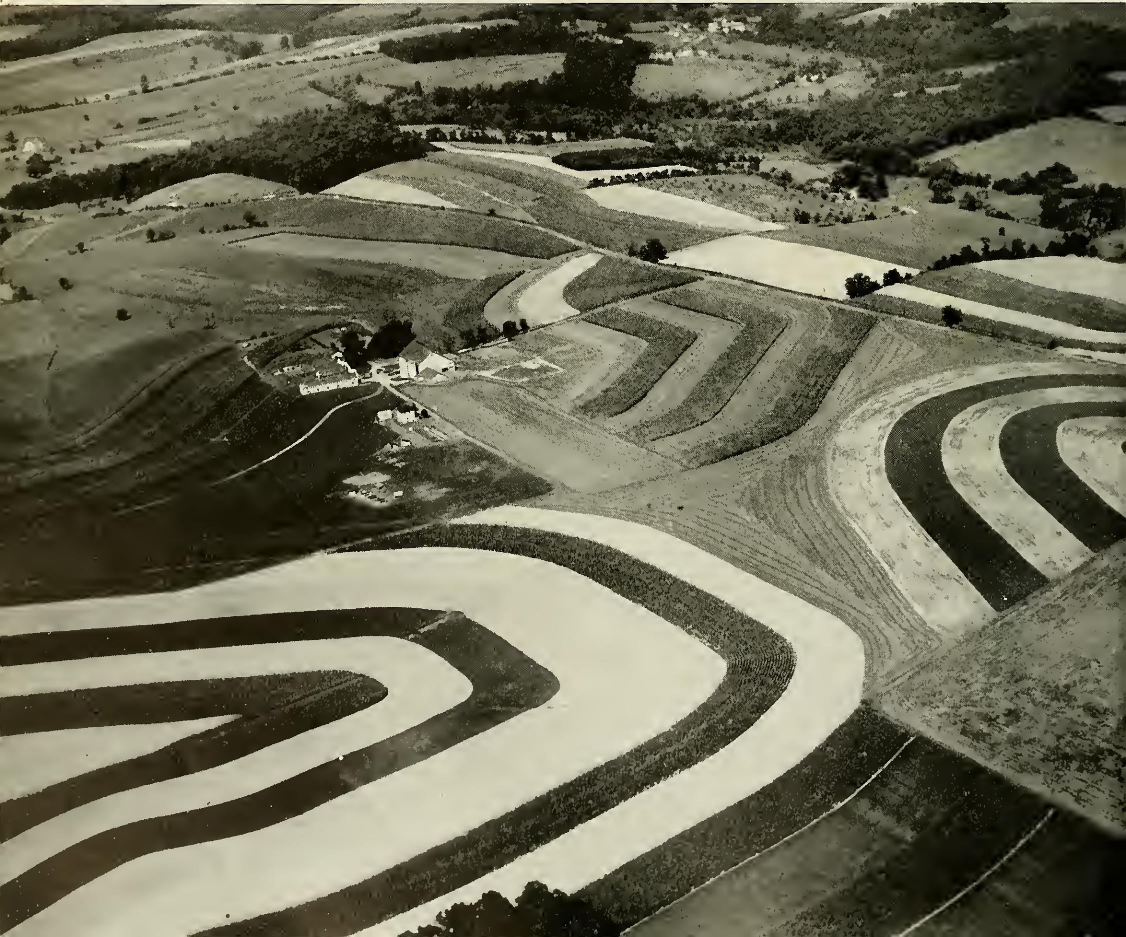
▲ STAFF MEMBERS who carried out the program of the Brandywine Valley Association. *Left to right:* Howard Mendenhall, Forester; Robert G. Struble, Agronomist; Rosemary Fyffe, Stenographer; Clayton M. Hoff, Executive Vice-President; Constance R. Blower, Secretary

Brandywine Valley Association

▲ EVEN WEEDS would hardly grow on this farm. A distinc feature of the Brandywine Plan is that it unites town country. This ruined farm would be looked upon not me as an agricultural disgrace but as a loss to the neighbor town, whose merchants once had this family's trade

▼ CONTOUR STRIP CROPPING near Gum Tree, Pennsylvania: a healthy piece of countryside intelligently tilled

U.S.D.A.-S.C.S. photo by Hermann Postlethwaite



U.S.D.A.-S.C.S. photo by Homer Coleman

◀ THIS WOULD HAVE BEEN a disastrous fire had it not been for a pond that the owner of the farm had built for $850

▼ THE SAME FARM, showing the remaining buildings that were saved owing to the presence of the pond. Innumerable ponds of this sort have been built throughout the Brandywine Valley as a direct result of the conservation program

U.S.D.A.-S.C.S. photo by Hermann Postlethwaite

the Brandywine" is a project with meaning for us all. Here, for the first time, a group of citizens have taken it upon themselves to lick *all* the problems that stand in the way of maintaining our basic resources. In the process, they are making their historic valley a richer, safer, happier place in which to live. And they have not sought one penny of state or federal funds.

It is no accident that this experiment in self-help has a national reputation—and a reputation that is growing. This is based on solid achievement, the evidence of which is there for anyone to see. Residents in the area are quick to point it out.

"We're proud of how much better our little watershed is looking," says dirt-farmer Brinton Reynolds, whose crops have more than doubled since he began to farm the conservation way.

"I didn't understand," said a pretty housewife, "why my husband, a city resident, should be interested in this enterprise. Now I've found out. If we want cheaper food and lower living costs, if we want better health and recreation, it's to our advantage, here in town, to support the organization and the work it is doing."

The "organization" to which the housewife was referring consists of a paid staff of 2 technical men and 3 secretaries, working with a board of 30 directors, drawn from all sections of the community and serving as volunteers. Their battleground is the 330-square-mile watershed of the Brandywine River, extending from the farmland of southeastern Pennsylvania to the industrial area of Wilmington, Delaware. Their weapons include the conviction that what they are doing for the 200,000 persons living within their valley can be duplicated on the Saginaw in Michigan, the Kaskaskia in Illinois, the Des Moines in Iowa, the Gasconade and Grand in Missouri, the Blue in Kansas, the Brazos in Texas, and most of our other 200 or so smaller river watersheds.

They feel that 200 such areas, dedicated to solving their own particular problems of waste and destruction, would promptly restore to the nation its ebbing strength. They have found that the sense of individual and local responsibility is still strong. They believe it must be used.

Like a lot of good things in America, the program came about because somebody got mad. It was a bright, sunny week end. William Winder (Chick) Laird, a young employee of the near-by du Pont

U.S.D.A.-S.C.S. photo by Hermann Postlethwaite

▲ CANADA GEESE have come to this ¾-acre pond built for about $1200. It is spring-fed and is stocked with bass and bluegills. It is for fire protection, recreation, and wildlife

Company, had taken his family for an outing on the river.

"What's that, cousin Chick?" The kids pointed to a floating mass of colloidal suds—a gray and rancid blemish on the face of the Brandywine. "It smells like medicine."

Strong medicine, too. It took the paint off the bottom of the canoe.

A few days later, young Laird called on the general manager of the local paper mill, who denied that his company was responsible for any inconvenience to the people who lived, worked, and played downstream. No waste, he said, entered the Brandywine from *his* mill. None at all. Laird, an engineer by training, was ready for that one.

"If I can prove it to you, if I can get an expert to analyze the flow. . ."

"I'll cut our discharge unit until he goes away," the general manager admitted.

Laird never forgot this incident, and when he bought a farm, he was careful to find one upstream from the mill. In his search for the place, he became conscious of the muddied, sometimes turbulent waters that flowed or raced through the fields. Here was a new kind of pollution, more serious because some of the best farmland in America was flowing away in it. Loss of recreation was one thing, but now, after each heavy rain, came evidence of increasing financial harm to the farmer and to the businessman with whom he was interdependent. It dawned on young Laird that soil erosion, flood and drought damage, industrial and municipal pollution, deforestation, vanishing fish and wildlife are all part and parcel of a single pattern of destruction. He knew that this cycle of evil reached out to affect not only the economic vitality of his neighborhood but its human values as well. Could something be done about it?

Among the people he consulted was another du Ponter, Clayton M. Hoff, and immediately things began to happen. Together with Edmond du Pont, ardent fisherman and river-bug whenever his native Brandywine is concerned, they decided to hold a meeting to see how much local interest there was. To a cross section of the community they sent fifty invitations. All but five answered. Thirty-five turned up for the fireworks.

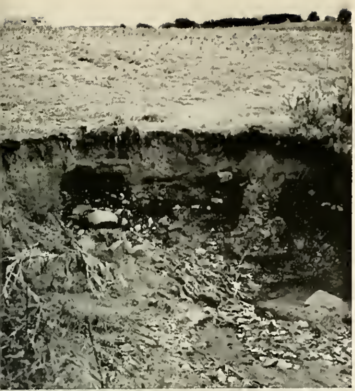
"We'll never get the fish back," said a spokesman for the sportsmen's group, "until the gosh-darned industrialists quit polluting our streams."

This was too much for Bob Wolcott, an official of Lukens Steel.

"I'll admit," said Wolcott, "I have to agree. But industry isn't the only guilty party. And it might be pointed out that if Lukens Steel were forced to shut down, the sportsmen would promptly lose 500 of their best members!"

Bob Wolcott, incidentally, is now the Chairman of Lukens Steel. And the sequel to the story is that his plant is putting in a water purification system that will set them back $300,000. The president of the sportsmen's group, on the other hand, has served peaceably on the same board with Mr. Wolcott, where they both direct the project that grew from that first meeting.

That conflicting interests were channeled into a productive program was due to the persistence and enthusiasm of the three men who had instigated it—especially Clayt Hoff. From a boyhood spent along the streams of northern Ohio, he had developed an intimate



S.C.S. photo by G. C. Lowary

A **TYPICAL EXAMPLE** of the "ulceration" at eats its way through a wrongly tilled ld

Brandywine Valley Association photo

A **FLOOD** on Radley Run near Pocopson. ·wlanders are beginning to place the ame where it belongs—on uplands de-uded of their proper vegetational cover rough disregard of good conservation easures

knowledge and appreciation of the natural world. Coupled with this quality, or perhaps as an adjunct to it, was his gift of bringing out the best in the people with whom he worked.

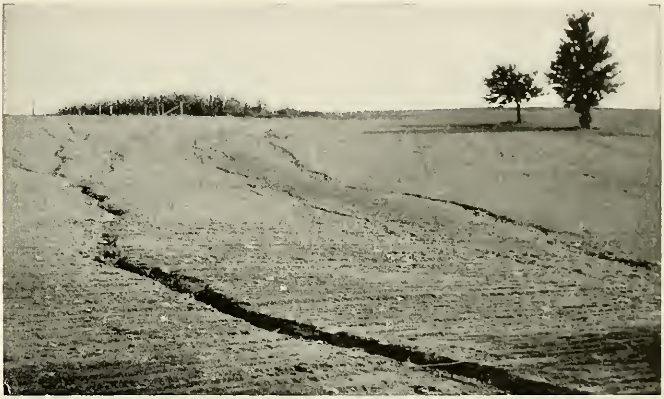
It was not long after the meeting in March, 1945, that the Brandywine Valley Association (a more inspiring word than Authority, the founders thought) was incorporated as a nonprofit, educational organization dedicated to what might be termed "total conservation, of, by, and for the commun-

U.S.D.A.-S.C.S. photo by Hermann Postlethwaite

▲ **PUMPING TOPSOIL** out of the Wilmington Harbor and Marine Terminal. The loss of this topsoil to farms of the Brandywine Valley costs the farmers over a million dollars each year. Then the taxpayers have to pay as much as $200,000 annually to deepen the harbor for shipping

▼ **IT IS** from fields like these that Wilmington Harbor is being filled. This erosion is the result of one rain. It would not have occurred if proper methods of farming had been employed

Brandywine Valley Association photo



▼ **GOOD CONSERVATION** practices put this field into good shape before it was too late. A few years before, it had gullies six to eight feet deep

S.C.S. photo

U.S.D.A.-S.C.S. photo by Hermann Postlethwaite

▲ **Contour strip cropping** helped this part of the valley to smile again: a fine example of conservation farming on one of the headwater tributaries of the Brandywine. Neighborhood meetings are being held in an intensive program to get the complete co-operation of the 75 farms in this watershed

U.S.D.A.-S.C.S. photo by Hermann Postlethwaite

▲ **That the next generation** may
better. Here a group of school childr
are being shown the trees planted
former students on their school forest pl

ity." Expenses were to be met by subscription and by dues. Membership was open to anyone interested enough to fork up two dollars to make his valley a better place to live in. County and state boundaries were by-passed; the theater of operations was the watershed of the Brandywine.

Ever try to tell a prosperous farmer that he is wasting his substance? Or point out to a successful businessman how to improve his methods? Or suggest to a public committee some little thing that departed from tradition?

To begin with, Clayt Hoff was a born diplomat. He also had the facts. With his own eyes, he had seen the terrific toll that floodwaters were taking from farm and industry and from the taxpayers generally. One factory alone got stuck with a $350,000 repair bill after a series of heavy rains. Through the Wilmington water department, he learned that around half a million tons of topsoil were sluicing down the Brandywine each year. During one day's rain, 16,000 tons ran off the land, enough to cover 16 football fields 7 inches deep. At its mouth, Army Engineers were busily pumping the stuff out at a cost of more than $200,000 a year. Upstream, he saw an increasing number of farms deserted, crops left standing because they were too poor to harvest. He saw the city of Wilmington converting for household use, by a chemical and engineering tour de force, water dark with silt and reeking with raw sewage. In the municipal park of downtown Wilmington there is a sign prohibiting children from wading where once the shad were so thick you could sweep them out with a broom.

He soon found a way to get his facts across. Again it was an old hobby that paid off—in this case, photography. While a businessmen's group relaxed over coffee and cigars, he would show them beautiful slides taken in the valley, then throw in a few shots of mutilated land or of their drinking water in the raw. ("Thank God," said one, "we saw these after lunch.") By such contrasts, plus a few well-chosen comments, he seldom left any meeting without converting someone. His converts had varying degrees of enthusiasm, especially when it came to action. Nevertheless, membership in BVA began to grow.

A glance at the office calendar shows that there's hardly a week that Hoff or his assistants don't have an invitation to give one of their talks. They have traveled up and down the east coast and as far west as Arizona at the request of citizens who want to know their story. Although personal contact with farm and business leaders and with state and federal agencies has been helpful in solving particular problems, Hoff believes it has been the illustrated talk that has brought the real success. Through it, they have aroused opinion to the point where farmer, businessman, and official are working together to preserve their common resource—the land.

Hoff says that since they have given their picture-talks, all of the Brandywine industries have installed, or plan to install, their own purification systems. Cities like Downingtown, Pennsylvania, have overhauled their sewage disposal plants. Wilmington has spent $600,000 and plans to put around $7,000,000 more into a modern unit for the hundreds of homes—and hospital—that have been using the Brandywine. It was the picture-talk that was decisive in persuading the Delaware legislature to pass a pure-stream law. In Pennsylvania, the clear streams program led by the then Governor James H. Duff nowhere had such support as on the Brandywine.

Farmers in the valley are beginning to realize that it takes nature hundreds of years to build even one inch of topsoil and that its loss soon brings them to the point of no return. Nearly half of them now have conservation plans.

People who do business with the landowners are also aware of the need for good land practice. Local bankers, under the guidance of BVA, now sponsor contests among the Future Farmers and 4-H Clubs. For the boys who adopt a certain number of soil-saving measures, they give cash prizes and trips to the great experimental farm of the Department of Agriculture at Beltsville, Maryland.

The importance to the region of "total conservation" is getting into the schools. At two state colleges, again with the help of BVA, conservation workshops have been set up for which full credits are given. The result is that about 60 teachers a year are being equipped to carry on this kind of work in their own classrooms.

Finally, taxpayers in all walks of life are beginning to catch on. "They not only get the farm view," says landowner and past BVA president Tom Harney, "but sometimes they get the valley view, or even see the thing as it affects us all."

Clayt Hoff thinks their goal of a complete conservation plan for every farm, a disposal plant for every city, and a waste treatment for every industry would have some startling results. In 1949, for example, he estimated that this plan would have put about $5,000,000 in the pockets of residents in the relatively small Brandywine valley.

The Carlin story is a case in point. From a farm that couldn't pay taxes in 1940, the two Carlin boys grossed $51,000 in 1948. Other factors were involved, of course, but Walt Carlin, Jr., who is one of the directors of BVA, will be the first to tell you that it is essentially a matter of land reclaimed and put to its best use—the conservation way.

Gradually, the whole valley is getting a new look. Half a million new trees and miles of wildlife borders have been planted. Forty-six hundred acres of woodland have been marked for selective harvesting. Instead of being hacked to death every generation, they are culled and marketed regularly, leaving a constant growth to hold back the water and the soil. Almost all of this has been done at the instigation of BVA.

Mallards and blue herons are coming back to the Brandywine and to the more than 50 ponds that have been constructed on the farms. This unmistakable endorsement by nature is confirmed by gauging stations of the U. S. Geological Survey. They show that rainfalls comparable to those of five years ago produce a third to a half less silting. Floodwaters, Hoff thinks, are down at least ten per cent.

According to Chick Laird, BVA will be hitting par when the life cycle of the bacteria and other micro-organisms on which plankton and algae feed (and on which,

▼ AND SO THE VALLEY smiles toward a happier future

in turn, all fish life depends) is allowed to run its course unmolested by agricultural or industrial pollution. Scientists have found that when these bacteria can grow normally, all of nature is in balance, from the crest of the highest farm to the water that spills into the city reservoir, many miles away. Laird doesn't know when that point will be reached, but he feels they are getting closer to it every day.

That BVA didn't sink without trace in a welter of good intentions is due not only to the qualities of the men behind it but to the fact that they knew what they wanted and how to work through the agencies already created for that kind of job. They have found a perfect counterpart for their educational work in the Soil Conservation District, a local committee that will put the landowner in touch with the federal Soil Conservation Service or any number of state and county organizations equipped to meet his needs. By a simple request to people he knows, he can obtain free services that include everything from a complete farm plan, with soil samplings and contour strips, to 100 pounds of bluegills for his pond. Though the legislation for its formation was already in existence (as it is in nearly all states), it was largely due to Clayt Hoff and his staff that the local Soil Conservation District was organized. It has proved an effective complement to the work of BVA.

"Sure," some citizens say, "BVA's doing a job, but how in tunket can you raise the $30,000-$35,000 a year needed for something like it out our way? You're talking about a rich man's hobby and a poor man's dream."

Clayt Hoff has two answers. First, he says, operating expenses wouldn't be so high in other parts of the country, especially with the experience of BVA to point the way. Second, he feels there are plenty of Americans left who would like to do something for their community.

For evidence, Hoff points to his incoming mail. As Executive Vice-President of the Brandywine Valley Association, he is getting queries from all over the nation. Most of them are from private citizens — bankers, industrialists, newspapermen — who have seen the damage that is being done in their communities and want to do something about it.

In 1945, there were five small watershed organizations in the country, according to the records of BVA. Today, there are nearly 100, and the number is growing. Already, representatives of these groups have met and voted to form the American Watershed Council for the exchange of information and ideas. Clayt Hoff was chosen Chairman, and he and his committee were given the job of working out a program. All this has been done voluntarily and at private expense.

Skeptics scoff at their community's ability to lift itself by its own bootstraps, and say it's a case of too little and too late. They point out that nature won't wait and that somebody else has to do something—at once. Moreover, they say that problems of navigation, power, and irrigation are involved, all of which means it is the government's job.

In any case, they regard organizations like BVA and the American Watershed Council as innocuous little algae on a political flood. The Army Engineers, the Bureau of Reclamation, and other Government agencies are building four and a half billion dollars' worth of projects, mostly for flood control, power, irrigation, and navigation. Nineteen billion dollars' worth is planned. The spending of twenty-nine billions more is contemplated in the long-range future. Meanwhile, there are about 50 men in Washington who are plugging night and day to divvy up the United States into nine Valley Authorities, taking over all elements of conservation, power, flood control, irrigation, and navigation.

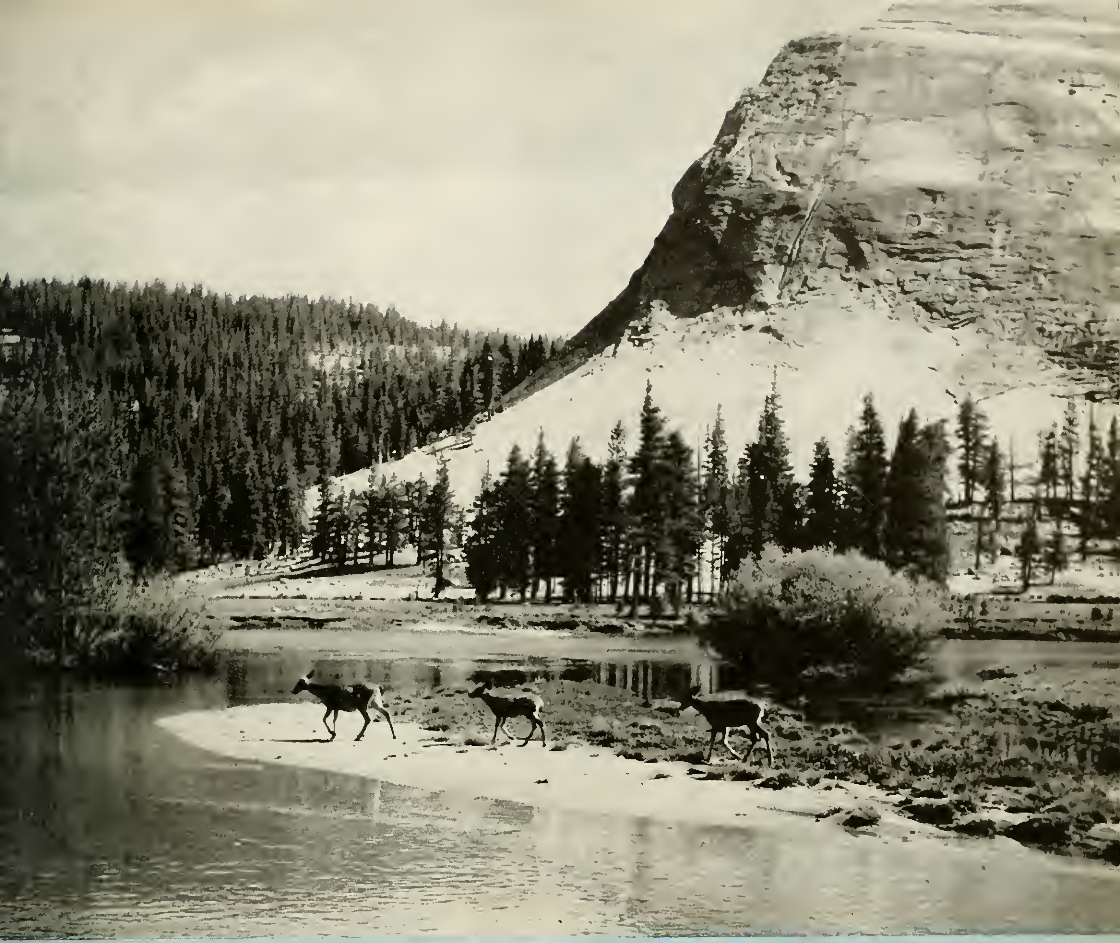
The pressure is fantastic. The Bureau of Reclamation and the Army Engineers—in whose super-lobby (The National Rivers and Harbors Congress) many Senators and Congressmen serve—have perfected a smooth-working machine for spending money on projects the taxpayers don't actually want. Only lip service is given to real needs of the land. Many citizens are converted to pressure groups by slick publicity that offers immediate advantages to a community at the cost of a long-term loss. The weary Senator who tries to make a fight is handed a telegram: "We support you in all efforts to cut the pork—just don't vote against any projects for us."

Clayt Hoff feels that if people really knew the problems of their own watershed area, there would be no conflict at all. He thinks people can and will do things for themselves before these programs are forced upon them. When the government builds dams that cover with water three-quarters of the land they were designed to protect, or when the useful life of multimillion-dollar dams is not over two generations owing to accumulation of silt, he says it's time to stop and think.

Let the people, he says, do what they can themselves with the agencies that exist in their own communities. When larger projects are called for, let regions band together, invite the state and federal governments in to work out what should be done. He thinks the American way is from the people up, not from the government down.

The initiative, he feels, is still with the individual. The individual can talk over local matters with his neighbor. He can form his own committee. Then he can get in touch with the American Watershed Council, 202 Transportation Building, Washington 6, D. C., a body made up of committees like his, which is pledged to his support.

There is precedent for it all; and if anybody wants to know if it's worth getting started, just look at what they're doing on the Brandywine!



▲ WHEN the cameraman got too close, the animals walked into the icy water and crossed to the opposite bank

Pleasant Moments in Nature

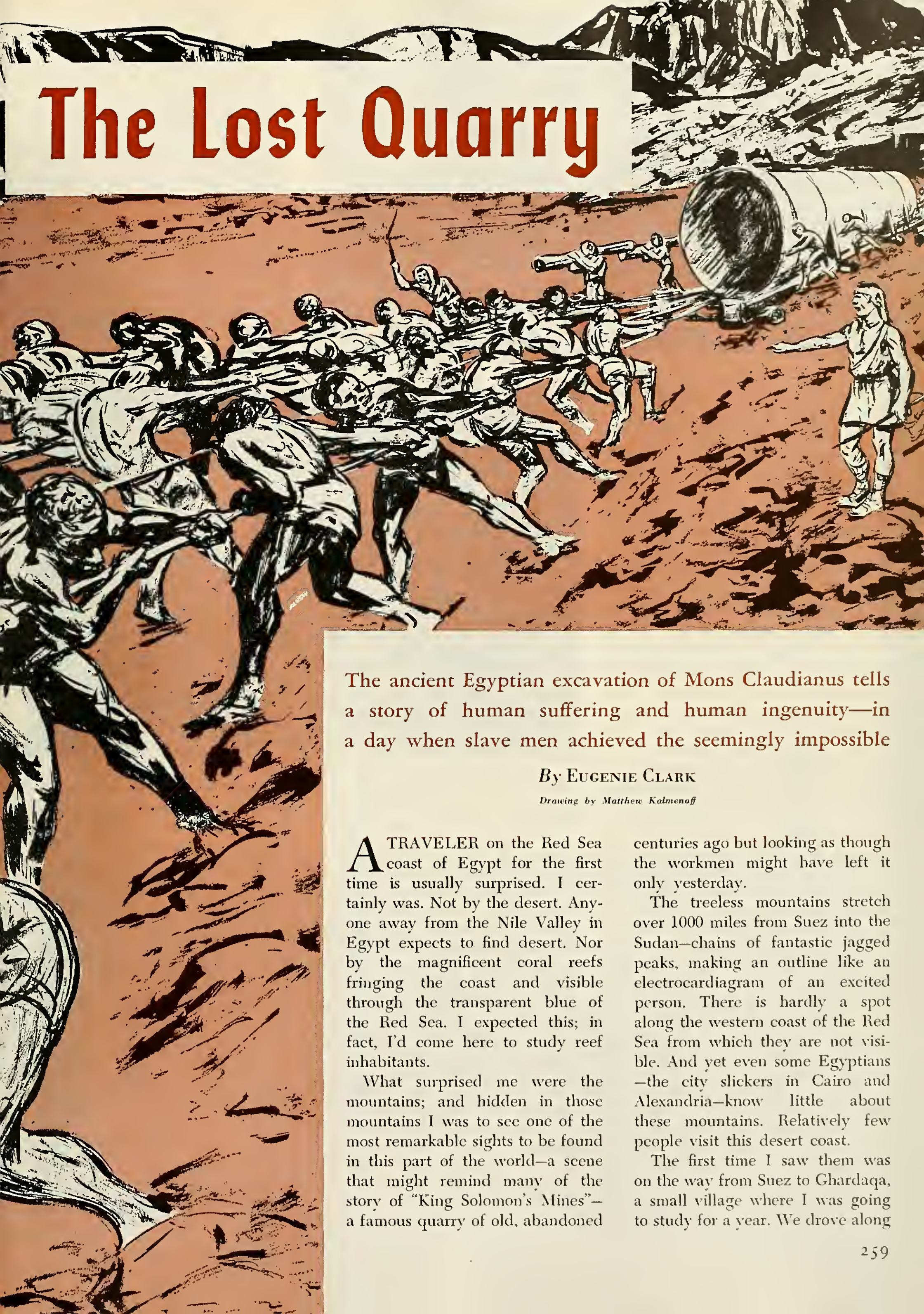
Observing mule deer in California's Sierra

By JACK DERMID

THE high country of the California Sierra is a superb combination of unmatched mountain scenery, sparkling clear waters, green meadows, blue skies, and brisk, clear air, with an abundance of wildlife adding the master touch. There are marmots on sunny boulders, ground squirrels peeping above the grass, mountain bluebirds singing from bleached pine snags, and inquisitive mule deer watching at a cautious distance. It is the kind of country that makes a man feel excited just to be there —he feels a part of it!

One June morning I was hiking along a stretch of the Tuolumne River at the upper end of Tuolumne Meadows in Yosemite National Park when I discovered these mule deer feeding near the base of Lembert Dome. They presented that perfect type of picture that is forever etched in the memory of outdoor men. After unpacking my camera, I began stalking the deer and spent 30 exciting and memorable minutes photographing their activities before they disappeared in a thicket of lodgepole pine.

The Lost Quarry



The ancient Egyptian excavation of Mons Claudianus tells a story of human suffering and human ingenuity—in a day when slave men achieved the seemingly impossible

By Eugenie Clark

Drawing by Matthew Kalmenoff

A TRAVELER on the Red Sea coast of Egypt for the first time is usually surprised. I certainly was. Not by the desert. Anyone away from the Nile Valley in Egypt expects to find desert. Nor by the magnificent coral reefs fringing the coast and visible through the transparent blue of the Red Sea. I expected this; in fact, I'd come here to study reef inhabitants.

What surprised me were the mountains; and hidden in those mountains I was to see one of the most remarkable sights to be found in this part of the world—a scene that might remind many of the story of "King Solomon's Mines"—a famous quarry of old, abandoned centuries ago but looking as though the workmen might have left it only yesterday.

The treeless mountains stretch over 1000 miles from Suez into the Sudan—chains of fantastic jagged peaks, making an outline like an electrocardiagram of an excited person. There is hardly a spot along the western coast of the Red Sea from which they are not visible. And yet even some Egyptians —the city slickers in Cairo and Alexandria—know little about these mountains. Relatively few people visit this desert coast.

The first time I saw them was on the way from Suez to Ghardaqa, a small village where I was going to study for a year. We drove along

◄ A CAR, a truck, and plenty of equipment for getting out of sand were necessary for the journey to the ancient Roman quarry west of the Red Sea

▼ A LONE BEDOUIN, encountered on the way, proved friendly and presented the expedition with the horns of a gazelle he had recently killed for food

Photos by Eugenie Clark

rough and winding roads that went over hot stretches of flat desert, over cool coastal trails obliterated at some high tides, and through valleys of the desert mountains, which always loomed near by. Dr. Gohar, the bearded Director of the small Marine Biological Station we were headed for, tore along these roads with veteran skill, while his "chauffeur" slept in the back of the station wagon on my pile of luggage.

A blazing, rosy sunset delineated the fantastic peaks, and the calm surface of the sea reflected a solid red. "Perhaps this phenomenon resulted in the naming of the Red Sea," Dr. Gohar conjectured, although most biologists assume that the name originated from the presence of tiny, red, pigmented organisms in the sea which, at certain seasons and under the right conditions, proliferate extraordinarily and cause what we sometimes call "red tide."

But at this moment, my attention was once more on the mountains. The barren rocky ranges, with their strange mixtures of sedimentary and igneous rocks, attracted the eye with their multivariations of yellow, brown, orange, purple, and black. Now they were fading to a uniform gray. The jagged peaks seemed even more fantastic—like an illustration from a book of fairy tales. I half expected to see a giant peer from behind one. What was in those vast mountain ranges? Did anyone live there? How could you get into them? Dr. Gohar answered my questions.

Except for a few desert frontier posts along the few remaining usable roads, hardly anyone lives in these mountains. Some Bedouins —wandering Arabs — weave their way through on camelback, sometimes taking months to cross the ranges. They know the locations of the few and distantly separated oases. The only other mammals you are apt to find are gazelles, ibexes, and rats—and these on rare occasions.

In one of these ranges there is a coptic monastery, St. Paul's, supposed to be the oldest in the world. "Women visitors aren't allowed," Dr. Gohar dashed my hopes. Recently a group of scientists from the U. S. Navy Medical Research Unit, concerned with the problem of malaria control, went on an expedition into these mountains, led by a Bedouin. In a puddle fed by a little trickling stream, they discovered a species of mosquito unknown to science. To make a trip into these mountains requires a good guide and at least two desert-equipped cars.

But at one time these mountains were not so desolate. In the first few centuries A. D. many thousands of people lived here in small square cities connected by a network of roads, mostly leading to Qena on the Nile. In the time of Philadelphus, the second Ptolemy (285-247 B. C.), a port was built at Berenice, and a road cut through the mountains from it to the Nile just south of Qena. A few hundred years later, the Romans came to exploit the wealth in these mountains. They mined gold and quarried granite and built many good roads with sentry stations almost every 30 miles. In these mountains they found the only source of "imperial porphyry"—a handsome red-purple rock flecked with white or pinkish felspar crystals. This rare granite, inaccessible today, was brought to Rome and later to Constantinople, where eight beautiful monolith columns of it can still be seen supporting the corner alcoves of the famous St. Sophia.

It was to see one of these historic quarries that a party of us made our way some weeks later deep into these mountains. Evidence of enterprises momentous to the classical world lent a strange fascination to the spot, and we were happy to be on our way to the ancient quarry at Mons Claudianus.

Mr. Albright, an official of the Shell Oil Company, was making an inspection tour of some oil fields along the coast of the Red Sea. The birthday of a local Shell Company official, Mr. Whiting, came on a Friday (the holiday of the Moslem week), and it was decided to celebrate with a trip to Mons Claudianus.

They called for me at 6 A. M. We had a car, a truck, and equipment for getting out of "sand traps." There were only five of us: Mr. Albright, Mr. and Mrs. Whiting, and a local Egyptian named Mahmud, who was supposed to know the desert and mountains as well as the gazelles.

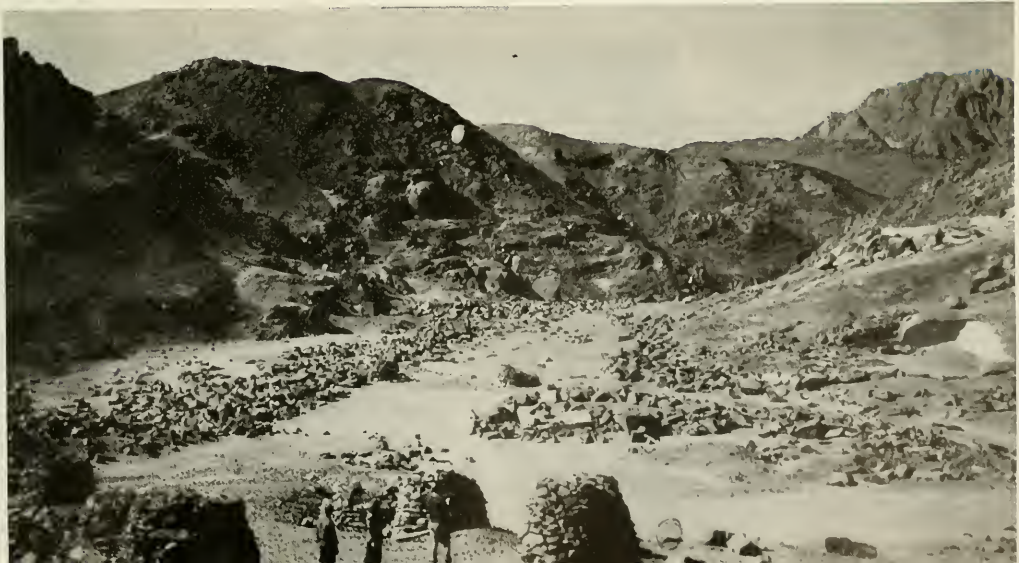
It was a cold January morning, but it grew hot as the day progressed and as we drove away from the sea coast into the mountains. I suppose we were following a road or trail, but most of the time it was visible only to Mahmud. Soon the mountains were in all directions and the sea was gone. We were in a narrow valley when we hit the first bad sand trap. There was no alternative trail, and both car and truck had to be shoveled out and driven over planks. I snapped pictures and tried to catch a lizard. If there's an Egyptian around, it's a waste of time for a lady to offer labor assistance, even if she's wearing slacks. We drove farther into the mountains and—into more sand traps.

Just when we seemed to be as far from another soul as a desert tourist party can get, we came across a lone Bedouin. He was sitting beside his little camp. His camel was near by, feeding on a few scraggly shrubs, its front legs tied together. I had to have a picture. We stopped the car, and Mahmud accompanied me. I tried my few words of Arabic in a greeting to the Bedouin, who was completely enveloped in garments except for his eyes, which, with two deep creases between, peered back at me. But there was no verbal response. Mahmud said politely, "He probably speaks another dialect." Mahmud proceeded to say almost my exact words to him but with the a's, h's, and g's farther down his throat. The center creases vanished, and wrinkles appeared on the outer sides of the Bedouin's eyes. I smiled back at him. He consented to have his picture taken and never mentioned the word "baksheesh." When we left, he presented us with the horns from a gazelle he had recently killed for food.

Deep in the mountains on our left, the valley we were following suddenly widened and an ancient wall appeared. We had reached the Roman Station. It was almost noon. Hiking up a hill, we looked directly down upon the ruins—hundreds of buildings huddled together in a square-walled enclosure. The remains of a large temple stood outside the square, with long, wide

▼ THE QUARRY covered several square miles. The regular stone mounds may have served as vantage points for the Roman guards who supervised the work

Photo by Eugenie Clark



steps leading up to it. We wondered how many Egyptian slaves and Roman outcasts knelt here after toiling in the hot sun all day.

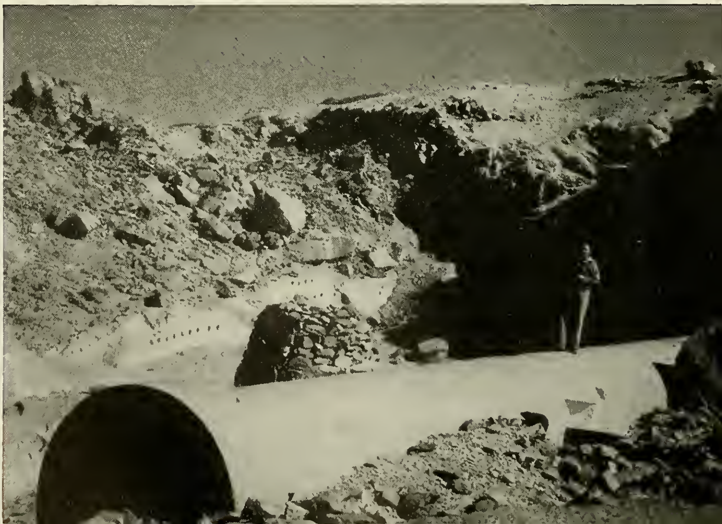
We continued over the hill to find the quarry that Mahmud knew was on the other side. It was a steep and rocky climb, and the road—once well used—had almost been obliterated by time. But you could be sure you were headed in the direction of the quarry. On this road, sticking out like a sore thumb pointing the way, was a fragment of a large gray granite column over eight feet in diameter. Trunnions for tying ropes to this column for transporting it protruded from the sides like huge nipples, each larger than the head of a man. A skid, projecting several inches along the bottom of the prostrate column, had facilitated the lugging of such a massive weight from the quarry. We passed by in awe and continued over the rocky hills to the quarry. The men lent a hand to Mrs. Whiting and me on some of the slopes. We wondered how the huge column we had just viewed had been pulled so far over this terrain.

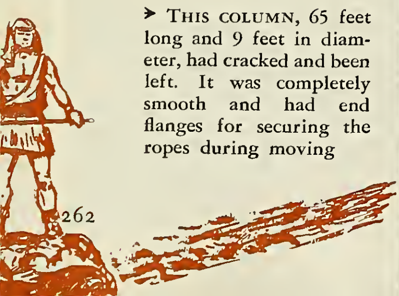
Then from the top of one hill, we looked down and in a wide valley below saw the quarry. It covered several square miles. Uniform mounds of stones about five feet high were somewhat regularly spaced around the quarry. Perhaps Roman guards once stood on these and whipped the slaves as

Ewing Galloway photo

▲ From one of the quarries in this region, the imperial porphyry columns of the famous St. Sophia were obtained. The task of dragging these columns to the sea and floating them to Constantinople must have been tremendous

➤ This column, 65 feet long and 9 feet in diameter, had cracked and been left. It was completely smooth and had end flanges for securing the ropes during moving





they passed. Glancing over the quarry, we could easily see where each of hundreds of rock masses had been chipped out. Along the sides of huge depressions, lines of regularly spaced openings could be seen—like windows from a city of miniature rock dwellers. These were actually wedge holes in which had been hammered pieces of wood, which, when moistened, swelled until they split off the rock along a previously cut groove. How big were the pieces that had been split off in one such operation? Thanks to an ancient accident, an accurate estimate could be made right here in the quarry.

An entire column of one piece lay in the quarry bed where it had fallen between the winching bollards over 1500 years ago. Its surface was completely smooth, and it had a finished look even to the end flanges used for securing the ropes in transit. The column was 65 feet long, almost 9 feet in diameter, and had a gigantic crack in it. If this column had not cracked, it would have been dragged by ropes from the quarry into a main valley. Its weight, estimated at over 200 tons, would then be supported on wagons. (Tracks of such wagons still survive, sanded up, in undisturbed gravel surfaces.) It would be pulled by slaves the incredible mountainous distance to the Nile and there floated down on barges, then across the Mediterranean to Rome. What accident had marred this column and prevented its trip to Rome, probably no one will ever know. But it gave us an idea of how large a piece of rock the ancient people could take out of the quarry.

We climbed out of the valley.

I looked back down the hill and visualized a swarm of thousands of men laboring in this shadeless quarry. One's thoughts easily spanned the centuries in a scene so remote, so ancient, and so little changed by time. I pictured over a thousand slaves pulling a giant monolith weighing hundreds of tons, while a slave-driver cursed out cautions. A slip, and the massive column cracks. The slaves have probably come to work this quarry as an alternative to being burned alive. What horror now seizes their hearts, what punishment awaits them? Or perchance do they feel delight at the prospect of their overseer having to answer to his superior for an accident costing thousands of man-hours of toil? What price may this cracked column have exacted, which today stirs the imagination of the occasional traveler who views it?

We continued back to the square-walled city. But first a drink for our parched throats and some lunch. We spread our newspaper tablecloth on the ground in the shade of a huge rock and sat down for our refreshments.

After eating, we browsed in the ruins, picking up bits of pottery still with the fingermarks of hands that worked almost two millenniums ago. Stone washbasins lay scattered among the close-set, crumbled buildings.

"Where did they get their water?" I asked.

Mahmud told us of a huge well and cistern a few miles away, made by the Romans.

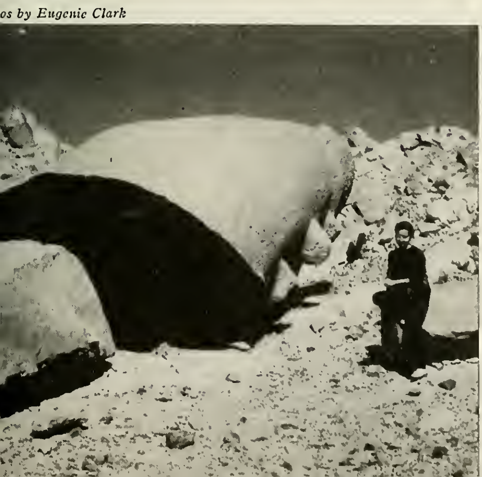
We walked through the temple. Toppled heads of Corinthian columns were strewn about among blocks with Greek inscriptions.

On the way back to Ghardaqa, we sidetracked several miles to stop at the well, once sanded up but recently restored. We cranked up a can of water, which, though brackish, must have tasted very good to many a Bedouin's camel.

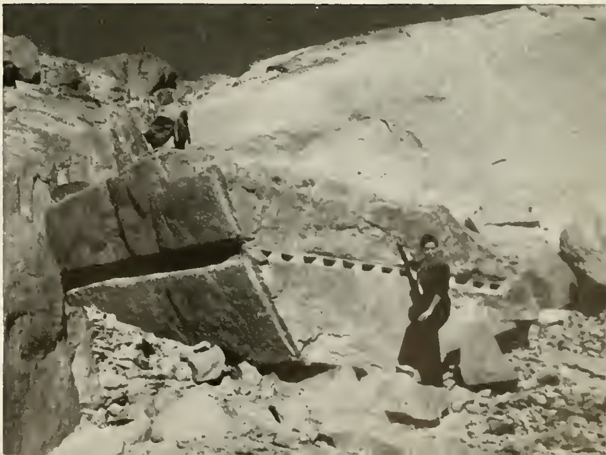
We went back on a different route and met fewer sand traps. The shadows deepened, and the naked mountains that had dazzled us a few hours earlier took on richer hues and the glare was gone. We passed one lone tree. It seemed to deserve being in the title of a book at least, like the one that grew in Brooklyn. On and on we drove, clothes and sandy perspiration clinging to us. With the incentive for our trip behind us, the mountains became monotonous. When they finally parted, we could see across a stretch of flat desert, and the straight horizon separated pale from deeper blue. The sea was a welcome sight.

A HEAVY FRAGMENT. The knobs were to hold the opes by which the slaves would haul the column to he Nile

os by Eugenie Clark

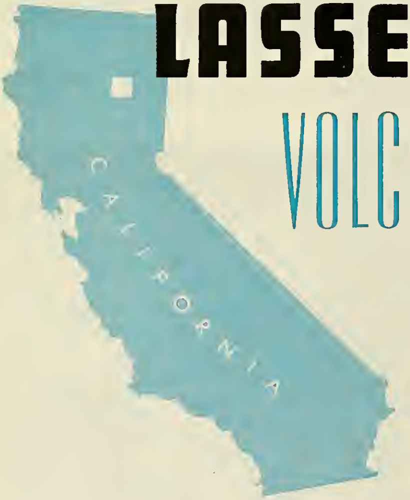


▼ INTO WEDGE HOLES like these, pieces of wood were hammered and moistened so that their swelling would split the stone



LASSEN VOLCANIC NATIONAL PARK

▲ LASSEN is not far from one of the main north-south highways of northern California


CALIFORNIA

LASSEN
VOLCANIC NATIONAL PARK

Verdant mountain meadows, snow fields, and bubbling springs make the lands surrounding this majestic peak an ideal vacation spot for the fisherman or nature photographer

By HUBERT A. LOWMAN

All photographs by the author

CALIFORNIA'S old, pink Lassen Peak, which rises 10,453 feet above sea level, is famous as the only recently active volcano in the United States, yet the surrounding country is surprisingly little known as one of the most beautiful and delightfully restful vacation retreats in the West. Placid lakes, rushing streams, lush mountain meadows, thousands of acres of open evergreen forests—all beckon those who wish to spend an idle hour, or week, or month. A fine paved road leads into the area and passes many points of interest.

Often it takes only a few steps away from the road into the woods to create the illusion that one is in a peaceful wilderness never disturbed by man or the elements. Certainly the havoc wrought here by the old volcano in times past—so startlingly evident in some places—is difficult to imagine as we wander along a trail and discover a silvery lake or field of gorgeous wild flowers, or startle a deer and watch as it bounds away in tremendous yet effortless leaps!

Volcanic activity in the Lassen area began a very long time ago. Lassen Peak had its origin about a million years before the Ice Age, developing along with other great volcanoes of the Cascade Range. Prior to the activity of 1914-21, Lassen apparently had been quiescent for a long period, and the peak was almost completely wrapped in a mantle of rock fragments which had tumbled from its own cliffs.

Meanwhile activity had been continuing a few miles to the northeast in the Cinder Cone area. The last eruption there was during the winter of 1850-51, when flaring lights were seen persistently at night from various distant points. Later it was found that a valley had been dammed up by a fantastic new lava flow and a new lake was forming.

First activity in the modern series of Lassen's eruptions was noted on May 30, 1914. Nearly a year later, on May 19, 1915, red-hot lava filled the new crater and spilled out through a notch and down the western slope for 1000 feet. The heat that rose up within the mountain melted the snow on its summit quite suddenly, and a destructive mud flow, with 10- and 20-ton boulders rolling along like tennis balls, swept 5 to 6 miles down the northeast slope. Three

▼ THE BEST KNOWN view of Lassen Peak is from Manzanita Lake at the northwest entrance to the Park

▲ **The dining lodge** at Manzanita Lake. The lodge, camp ground, and store are situated near the Lake

▼ **Timber-line trees** at 8500 feet above sea level on the side of Lassen Peak

days later, a terrific horizontal explosion, also on the northeast slope, felled a whole forest in a moment. Trees for a distance of three miles were laid down uniformly, all pointing away from the peak. A vertical column of smoke and ash rose more than five miles into the air. This largely exhausted the old volcano, although it grumbled and demonstrated spasmodically until February, 1921.

Although the Arguello exploring party of 1820 named it St. Joseph's Mountain, the peak today bears the name of a pioneer northern Californian, Peter Lassen. He came to this country from Denmark and piloted emigrants from Humboldt, Nevada, into the Sacramento Valley, using Lassen Peak as a landmark. Indians scalped him in 1859 while he was on a prospecting trip.

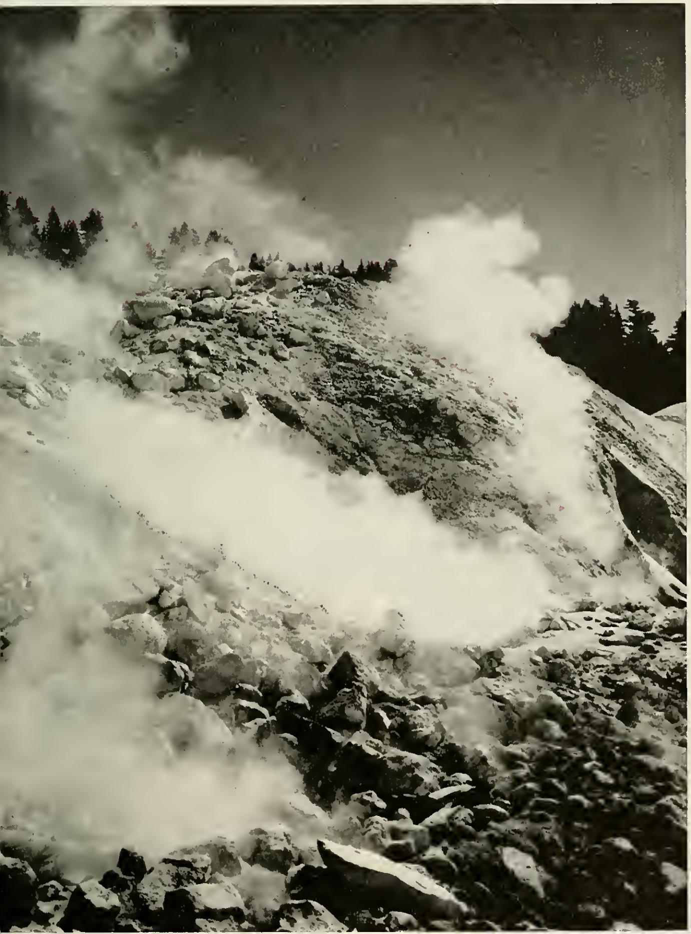
Lassen Volcanic National Park was established by Act of Congress on August 9, 1916. It includes in its 166 square miles both the Lassen Peak and Cinder Cone areas.

Owing to the high altitude and generally moist weather conditions in northern California and the Pacific Northwest, the Cascade Range is covered in winter by a huge snow pack. Devotees of winter sports express a growing fervor for the Lassen region, and ski slopes may usually be found in higher elevations as late as August. However, the winter season officially ends with the Mid-Summer Tournament near the end of June.

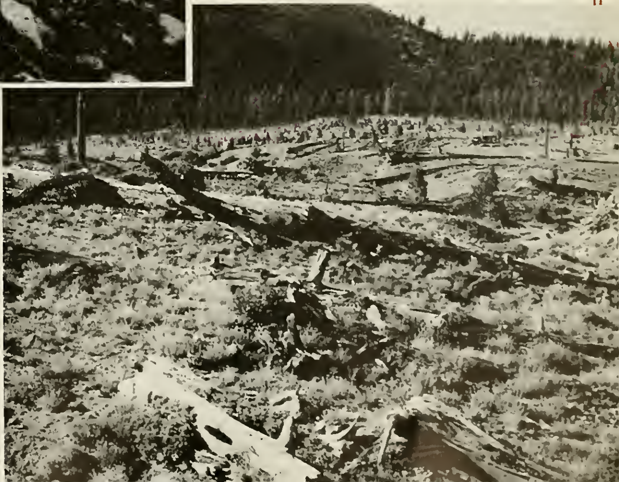
The Lassen Peak Highway, which crosses the western half of the Park and reaches an elevation of 8512 feet, is closed by snow during the winter and is normally not open for public travel until near the end of June. Even then it is only spring at this elevation, and another month passes before things are dried up and green enough to produce the wonderful summer scene that must be seen and *felt* to be appreciated.

While a week or two is recommended for anyone who would really become acquainted with this place of striking contrasts, much can be seen in a short time when necessary. Northbound travelers on U. S. 99 in California may detour at Red Bluff via State Highways 36, 89, and 44 through the Park and back to the U. S. Route at Redding, or southbound vice versa. The loop adds only 100 miles to the journey. Allow most of the day for the trip.

Entering the Park from Red Bluff, you come almost immediately to the Sulphur Works, an area of steam vents and boiling mud pots in the *caldera*, or collapsed crater, of another old volcano called Mt. Tehama. This was once an enormous peak which towered at least



▲ At Bumpas Hell, steam vents, bubbling mud springs, and hot sulphurous gases attest to the fact that the great volcano is not completely dead. Park Rangers say that these areas where there is still evidence of recent activity are safe if the visitor stays on the trails



➤ The last major eruption of Lassen Peak in 1915 destroyed the forests on one side for a distance of over three miles from the crater. Fallen trees pointing uniformly away from the blast can still be seen

▲ **SUMMIT LAKE**: one of the tranquil spots amid cool evergreen forests awaiting the vacationist at Lassen Volcanic National Park

4000 feet above its broken remnants—judging from the more than 12-mile diameter of its base and presuming that it rose at the angle common to other Cascade peaks. There is not the display at Sulphur Works that may be seen at Bumpas Hell, however. So, if you can walk a couple of miles on an easy trail, by all means drive the seven miles from the Park entrance past Emerald Lake to the sign indicating "Bumpas Hell Self-guiding Nature Trail" and park your car for an hour or two. Pick up a free guide leaflet and prepare to learn firsthand that the old volcano is not dead but only sleeping! Incidentally, the National Park Service insists there is perfect safety here as long as one stays on the trails. But the fire-and-brimstone odors and warm ground beneath the feet encourage butterflies in the stomach, even so!

Back on Lassen Peak Highway again it is less than a mile, past Helen Lake, to the foot of the Lassen Peak trail. Better not attempt this climb unless you intend to stay in the park overnight. Note the picturesque timber-line trees beside the road here. They are the white-bark pine.

If you brought a picnic lunch, there is no finer place to consume it than just down the hill at verdant Kings Creek Meadows or a few miles farther at Summit Lake. Otherwise, go down past the Devastated Area and Chaos Jumbles to Manzanita Lake Lodge for the meal. While there, visit the Loomis Memorial Museum and see the old photographs of the eruptions and the dioramas of geological history. After the museum experience, you may want to backtrack and examine the Devastated Area more closely. The fallen trees still lie there, all pointing away from the peak. But save an hour to admire the view of Lassen Peak from Manzanita and Reflection Lakes back near the lodge before leaving. Photographers often find this last look by late afternoon light the most thrilling of all.

If you plan an overnight stay, by all means have advance reservations at Manzanita Lake Lodge, unless you camp or pull a trailer. Lassen Volcanic National Park is primarily a campers' park, and a number of fine camps with modern conveniences have been developed in beautiful and accessible spots.

The climb to the summit of Las-

▲ Even before Lassen Peak was formed, there was a vast volcano whose base was more than twelve miles in diameter. Mt. Tehama, as it is called, has largely fallen into its own crater to form a great bowl, where hot springs indicate the existence of hot lava not far below. This view shows a portion of the old rim of Mt. Tehama, from the trail to Bumpas Hell

sen is a fine project for a second morning in the Park. The view is magnificent and the blocky lava in the crater interesting. The sign says two and a half miles to the summit and promises that the round trip can be made in three hours. Allow four!

An interesting short walk is down Kings Creek from the meadow to Kings Creek Falls. A longer walk into the beautiful forest and lake country starts at Summit Lake, and there is no better way to spend a summer afternoon. If those brogans are beginning to give out by now, this trip can be made on horseback. The corrals are at Summit Lake.

The Cinder Cone and Butte Lake area can be reached by car only by a roundabout Forest Service dirt road, but this bizarre section of the Park is well worth the effort. Take your lunch and make a day of it. Campers will find a developed campground, but there are no other facilities.

Or, bring your fishing tackle and spread your stay to a week or more. Instead of a tour, it will then be a vacation. The National Park Service maintains that the ease of access to good fishing here is extremely worthy of note. Rainbow trout are most abundant, and Loch Leven and Eastern Brook are plentiful in some waters. The many lakes and streams are stocked regularly. Why not try your luck?

▼ Kings Creek Meadows, with Lassen Peak in the background, provides one of the pleasantest picnic spots in the Park

Boussingault—Scientific Adventurer

Concluding adventures in the exploratory journeys of Jean Baptiste Boussingault, illustrious French scientist of the nineteenth century, drawn from his rare and almost unknown memoirs

By Victor W. von Hagen

JEAN BAPTISTE BOUSSINGAULT worked with delight on what his friends called his "*souvenirs glorieux.*" It was a splendid potpourri of scientific observations, travels, explorations, and personal narrative. But he dealt with his life in his own fashion, without troubling about proportion, without seeking conventional literary forms. As he dictated his memoirs to his daughter, who in acting as his amanuensis was at turns shocked, amused, and then incredulous at her father's adventures, he leaped whenever it entered his head to do so. He was astonishingly agile and capricious and had a droll sense of comedy.

"Thank God," he would say, after relating some piquant anecdote, "I have pantagruelized like the rest of the world," and then he would water down the biting flavor of one of his personal observations with remarks on the temperature, the altitude, or the geology. But to keep some order in the narration of his life, as he approached the ten-year scientific adventure that occupied him in South America between the years 1822 and 1832, he said, "To these accounts I shall give the title of 'Life in the Andes,' in those mountains where the best years of my youth were spent."

He began in Caracas, where he arrived with the others, in a night as black as a wolf's mouth, on December 7, 1821. Then, after acclimatization, he began an exploration of the mountains and the plains of Venezuela, already made famous by the classic researches of Humboldt. It seemed that Boussingault measured everything. He weighed the air, took his barometer up mountains, across the llanos.

The expedition fanned out across the anemic llanos, prying into all their wonders. It was the first time that a trained chemist had ever subjected all the natural phenomena to analysis. So Boussingault investigated the famous Cow Tree, a species of Moraceae, which when cut sends out a flow of sweet and pleasant-tasting "milk" sap. He examined the papaya and the chemical composition of bananas, and gave the first chemical analysis of the famous curare arrow poison. He took temperature readings everywhere and thus laid down the first connected chain of meteorological observations across the face of South America. On clear evenings, he looked at the stars. This attracted the natives, who wanted to see the little moons that glided around Jupiter. The irrepressible Mariano de Rivero told the simple people that, "Not only were there mountains, volcanoes, rivers, and lakes on the moon, but there were also men and women."

"'All baptized!' shouted Johnson, our Negro, 'all baptized,' and he added in French when I scolded him, 'It'll make them happy that the inhabitants of the moon are Catholics.'"

These "little moons" brought out General Paez. He was the famous guerrilla leader, and he broke through the Spanish siege lines—for war still raged in Venezuela—in order to come to see the *lunitas* —the little moons of Jupiter.

"I had expected," said Boussingault, "to see a warrior, a sort of Cossack chief whose lance had killed so many Spaniards, but I had before me a pleasant-looking cavalier with a good-looking face . . . of medium height with an astonishing suppleness of body." This was the first of the famous South American leaders whom Boussingault was to know while he was in the Americas, and he was much taken with this simple-headed myrmidon who would one day be Venezuela's first president and was to dominate its politics until 1860.

"Paez was not only the first but the boldest of the lancers," said Boussingault. "He did not command, he went in front, they followed; foam came out of his mouth, then often in the middle of the carnage, he would fall, struck down by an attack of epilepsy. After the action, one would find the General . . . taking the medicine he preferred most, which he always carried with him. And what medicine! A terrible poison . . . the *curare*, and a dose capable of killing 50 people if it were introduced into the bloodstream, but harmless when taken internally."

Boussingault and his companions

▲ **Jean Baptiste Boussingault** in his academic prime. Close friends, realizing his talent for informal narrative, induced him to write and publish privately the story of his eventful life

Photo by Victor W. von Hagen

▲ **A modern scene** near Quito along the trail of the expedition Boussingault accompanied in his twenties. Just behind the mountain in the center is the volcano of Pichincha, which was climbed by Boussingault with Dr. Jameson and Colonel Hall of Philadelphia in 1832

soon realized that there was danger everywhere. At any moment, the enemy might appear and, since it was a war to the death, the explorers would, if captured, be dispatched at the end of a rope before they could even prove that they were noncombatants. And although, as he said, "he had spent a month in Maracay in the most agreeable and instructive fashion," time had come when the expedition had to shape its way toward Colombia—a thousand miles by trail through areas still infested with the enemy. Boussingault felt himself ready: "I had familiarized myself with the culture of the tropical regions, and I was beginning to pronounce Spanish passably well, thanks to Señorita Rafaela, who used a teaching method appropriate for the education of parrots. She would pronounce a word and I would force myself to repeat it, vibrant, sonorous, just as I heard it from her pretty mouth."

Not long after that they made the passage of the Andes.

The years passed with a speed that young Boussingault could scarcely measure. The wars for independence had been won in 1824 in faraway Peru at the Battle of Ayacucho. Peace—but a troubled peace—had settled over the Andean lands, and Boussingault kept to his explorations. By the time the year 1827 had come and gone, the expedition had surveyed much of the natural resources of the Territory of Gran Colombia. The explorers had gone down into the Upper Amazon; they had gone up and down the rivers that cut through Colombia; they had collected many scientific specimens as they went; and they had assessed the mineral wealth of the country.

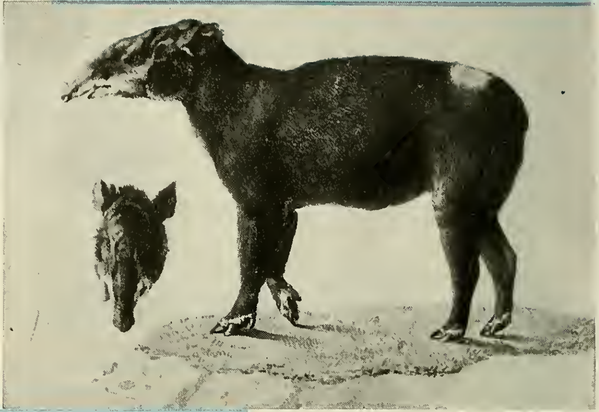
In the process of passing back and forth across the face of that variegated land, much that was new to science was found. Désiré Roulin, while going across the bald mountain heights of Colombia, discovered a new species of tapir, the Hairy Tapir, with hair almost as thick as a bear's. To find a new species of large mammal over 300 years after the discovery of America testified to the vast pockets of unknown territory still in the Andes. Désiré Roulin portrayed the animal and described it, but only recently was the first living example brought back to the United States.

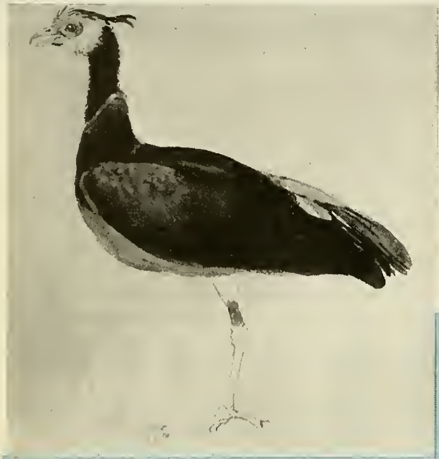
The immensity of Boussingault's researches can only be fully appreciated when one looks at his bibliography. He was charged by the Colombian Government to prepare a survey of the country's natural resources. In this capacity, he not only opened up mines, but he did basic research in metallurgy and in the composition of the air in the high Andes and in the jungles. He studied the increased intensity of sound at night and the nocturnal variation of the barometer in the equatorial Andes. All these and a multitude of other scientific activities necessitated car-

Photo courtesy of New York Zoological Society

◂ The Hairy Tapir, named *Tapirus roulini* after Dr. Roulin, who discovered the species. This photograph shows the first Hairy or Mountain Tapir brought to the United States, now on exhibit at the Bronx Zoo.

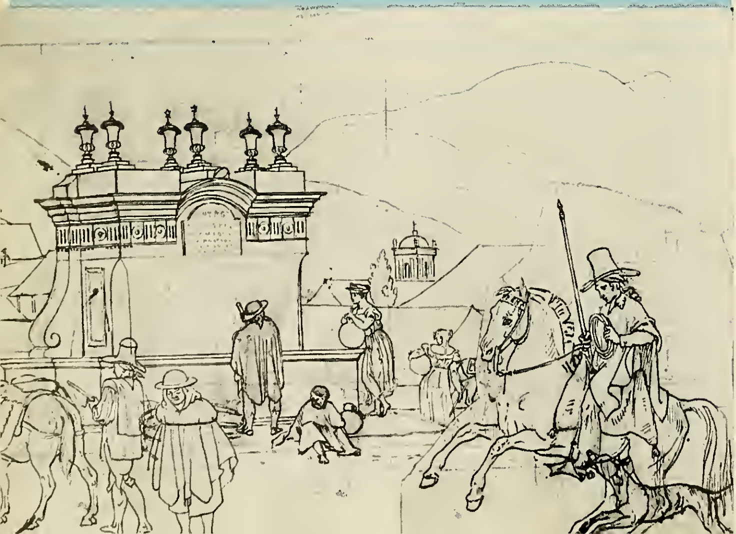
▾ A sketch of the Hairy Tapir by the expedition's artist, Roulin, most of whose remarkable drawings have never before been reproduced. Roulin was a physician and zoologist as well as an artist





◂ An unfinished sketch of the Crested Screamer, a bird of the swampy parts of northern South America

▾ People and places in Colombia: The main plaza of Bogotá, from whose fountain the townspeople drew their water. Note how classical are the figures of the woman and the almost Grecian horse. Roulin was never quite able to free himself from the Greek and Roman tradition under which he studied



rying delicate instruments over a terrain filled with Dantesque horrors. His researches in South America and later in France produced a long series of scientific papers. No fewer than 215 of them were listed by Alfred Lecroix in 1926. His writings are as important for their pioneering in a then new science, chemical agronomy, as they are in the charm of their presentation. Boussingault was addressed by his German colleagues after the Franco-Prussian war as "*Au premier chimiste agricole*", the first agricultural chemist. And all of this fame grew out of his explorations in South America.

By 1830, Boussingault was sitting in a spectator's seat looking upon the dissolution of Gran Colombia. General Bolivar's dream of a Federation of Venezuela, Panama, Colombia, and Ecuador was dissolving in chaos; there were political murders. Boussingault knew almost every one of the dramatis personae, and his pen, which had been so adept in writing chemical formulas,

M. A. Rodriguez photo

▲ **The Plaza de la Aduana** in Cartagena. To and from this fortress city the French expedition went numerous times during its stay in Gran Colombia between 1822 and 1832

now in retrospect drew sharp word-portraits of generals, statesmen, ambassadors, strumpets, and picaros. He was there when the Duc de Montebello, an agent of the King of France, arrived in Bogotá to offer a crown to Simon Bolivar under the protection of the King of France. He met William Henry Harrison, our first Ambassador to Gran Colombia, who later became President of the United States. General Harrison had won the Battle of Tippecanoe, which made his military reputation; he had served some years in Congress and was then appointed to Colombia. Boussingault remembered this "old public servant of the United States" as having angular movements and not a very high education. He affected extremely demagogic opinions, Boussingault tells us. "At a large dinner given for the celebration of the Battle of Boyaca [Colombia's "Yorktown"], someone made a toast to the memory of the two illustrious liberators of America, Bolivar and Washington. Old General Harrison got angry and, waving his glass, added with rather vulgar intention: 'Washington dead is worth more than Bolivar alive . . .' Following a violent quarrel, the Minister of Foreign Affairs asked General Harrison to leave Bogotá.

"'I will only leave by force,' replied the General, arms folded in front of him. And he remained. However, a short time later he was recalled by his government." He ran for the presidency of the United States on a Log Cabin and Hard Cider platform and was elected but served only 31 days.

Boussingault was living with history, and his observations of people are etched with biting Gallic irony. "Bolivar," he recalled in concise portraiture, "was a small man under average height, carrying a head rather out of proportion to his size; but very energetic, with a bright look, brown eyes, black hair, tawny complexion, arms too long, thin limbs, a great vivacity in his movements. The general was then in all the brilliance of his renown. His power was practically unlimited . . . Napoleon was his ideal. . .

"Bolivar was an expansive personality, kind to his inferiors, generous to excess, living in a very simple manner, sober, but liking women and sought after by them, as it happens to men of power. He was a man with a fine mind, of good education but of great susceptibility to vanity. . . His tempers were sometimes grotesque. . .

"I arrived one day at Ibague to pay my respects to the Liberator; he had returned from Peru and was out of humor. He asked me to dinner, and although I was, with my title of colonel, of the lowest grade present, he made me sit next to him. The conversation was of the gayest. Then, wanting to pay court to the great man, I said:

"'General, I received a newspaper from Paris, the *Globe*, in which there is an article that praises your Excellency most highly.'

"That, I told myself, will delight the general. Instead of which . . . he took on a menacing expression and, turning to me in a rage, said:

"'What! There is a newspaper from Europe containing an article favorable to me and you haven't translated it. Undoubtedly they have attacked me or criticized my political actions; if not, a translation of it would have been promptly made!' And he continued in that tone.

"I told myself, 'Well done, Boussingault, that will teach you to pay court.'"

But the great man held no grudge against me; for while having coffee, Bolivar approached me, let me know that he wanted to establish a military school in Bogotá where officers would have good scientific instruction, and asserted that he was assigning the direction to me. . ."

On the night of the 25th of September, 1828, conspirators tried to assassinate General Bolivar.

Boussingault had returned from an exploration of the Tolima volcano—an enormous mountain which thrusts its glacier-crowned head 19,000 feet into the Colombian sky—when the conspiracy broke.

Photo by M. A. Rodriguez

◀ **Streets** like this in Cartagena hav remained virtually unchanged since 165 Cartagena, with its large fortresses an walls, was the most important city in th "Indies" when Boussingault visited it

There had been smouldering indications of it for some time. Gran Columbia was coming apart at the seams, and the entire blame for it was laid at Bolivar's door. A motley group of conspirators decided to kill the Liberator. They penetrated the government palace, killed the guards, wounded his aide-de-camp, and would certainly have killed him had it not been for the great presence of mind of his adored Manuela. He wanted to fight off the assassins and jumped out of bed in his nightshirt.

"Can you imagine," Manuela said later to Boussingault, "can you imagine! He wanted to defend himself. *Por dios*, how comical! Here he was in his nightshirt, sword in hand. Don Quixote in person. If I had not dressed him and shoved him out of the window, he would have been a dead man."

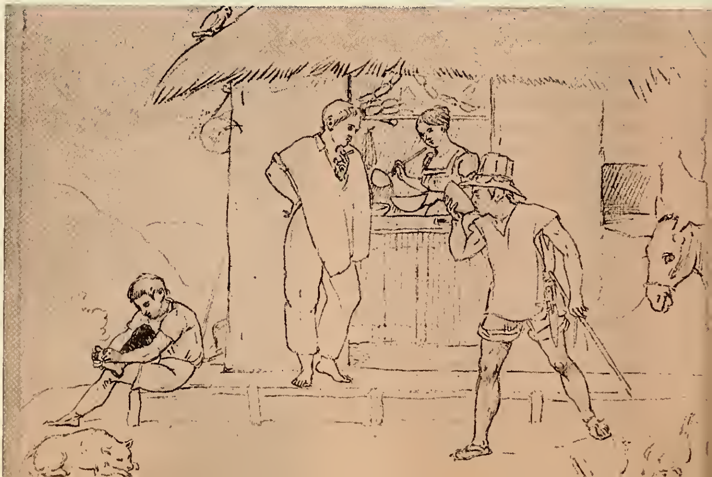
Boussingault spoke at length about Manuela.

"She was born in Quito," he wrote, "at the beginning of the century [actually 1797] . . . At seventeen she entered a convent as a boarder. . . The nuns taught their pupils to read and write; that was all a young girl of good family had to know. Manuelita Saenz was abducted from the convent by a young officer named Delhuyart, son of the chemist to whom we owe the discovery of tungsten. Manuelita never spoke much about her flight from the convent. We find her again in Lima, at the beginning of hostilities between the patriots and the legions of Spain. She was then married to a respectable English merchant, whom she left to live with the Liberator, then in all his glory. . ."

Thus Boussingault, the scientist, wrote of Manuela. He gave her an extraordinary amount of space in his memoirs—indeed, three times the space he gave to Bolivar himself. He told of her eccentricities, of how she danced the notorious *ñapanga*, a sort of Ecuadorian cancan. Boussingault gave pages to her Negro slave Jonotas, ". . . a mulatress with woolly hair, a handsome woman, always dressed as a soldier . . . the shadow of her mistress . . . a born mimic."

In this manner, Boussingault dictated his memoirs—sometimes to his daughter's embarrassment but to the delight of a limited nineteenth century audience, who were surprised to find a scientist and explorer so candid.

▼ A **wayside restaurant** in the Montaña of Colombia as sketched by Désiré Roulin. The man drinking is a muleteer. His dress, a modified Indian costume, is seen along the trails of the land even to this day



RESERVING A BLEND of Spanish civiliza-
n and native Andean culture, the city of
gotá was a center of diplomacy and politi-
strategy during the turbulent decade that
ussingault spent in the New World

Photo by Victor W. von Hagen

It was toward the end of his ten-year scientific expedition to South America that Boussingault decided it was time to visit Ecuador, to climb its snow-covered volcanoes, and to look upon the land made classic by the earlier explorations of Humboldt and Bonpland. Again Manuela Saenz enters the picture:

"One night I went to her house to get a letter of recommendation that she had promised me. This letter was addressed to her brother, General José-Maria Saenz, then residing in Quito, where I was going. She had left the dinner table and received me in a small drawing room. During the conversation, she praised the skill of her countrywomen's embroidery and as proof wanted to show me an artistically worked petticoat. Then, without any fuss and in the most natural way in the world, she took the bottom of the petticoat she was wearing and lifted it in such a way that I might see the really remarkable work of her friends.

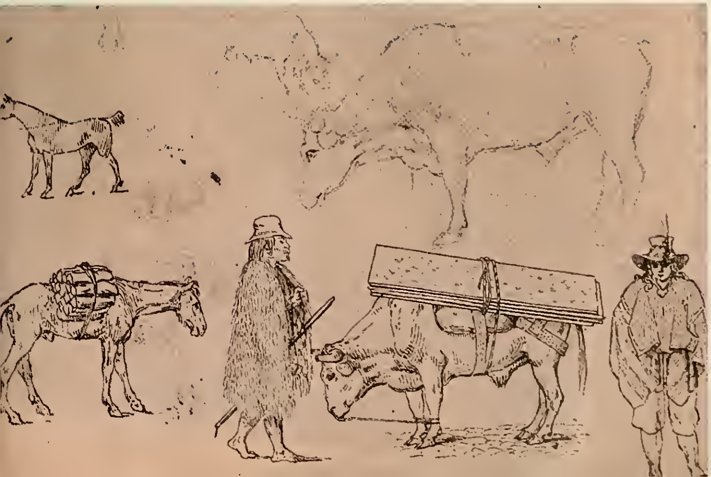
"'Look now, don Juan, look how this is done.'"

"But done to a turn," Boussingault replied, with the confusion he was sure Manuela expected.

Months later, he delivered his letter of introduction to General Saenz, and since he was an officer on Bolivar's staff, he was given aid. So he began his explorations of Ecuador. Burdened with all his instruments, he climbed the volcano of Pichincha, which raised its shaggy head back of Quito. His companions were the ill-fated Philadelphian, Colonel Hall, soon to be shot for having taken the wrong political side, and the indefatigable Dr. Jameson, whose name is associated with hundreds of plants found in Ecuador. "Dr. Jameson," said Boussingault, "was a person who lived only for the plants, an ardent botanist and collector."[*] Together these three climbed most of Ecuador's famous avenue of volcanoes, and it enabled Boussingault to make an analysis of the air and to study the effects of the altitude on breathing and circulation. Boussingault, since he planned an early return to France, did not spare himself. He traveled widely through Ecuador and so,

Continued on page 284

CASUAL SKETCHES by the expedition's artist: wayside glimpses of modes of
avel and dress in the high Andes as observed by Désiré Roulin. A Cholo, or
estizo, is seen wearing the grass cape of the highlands. The young bull is serving
a beast of burden. The man at the right wears a ruana and a large straw hat



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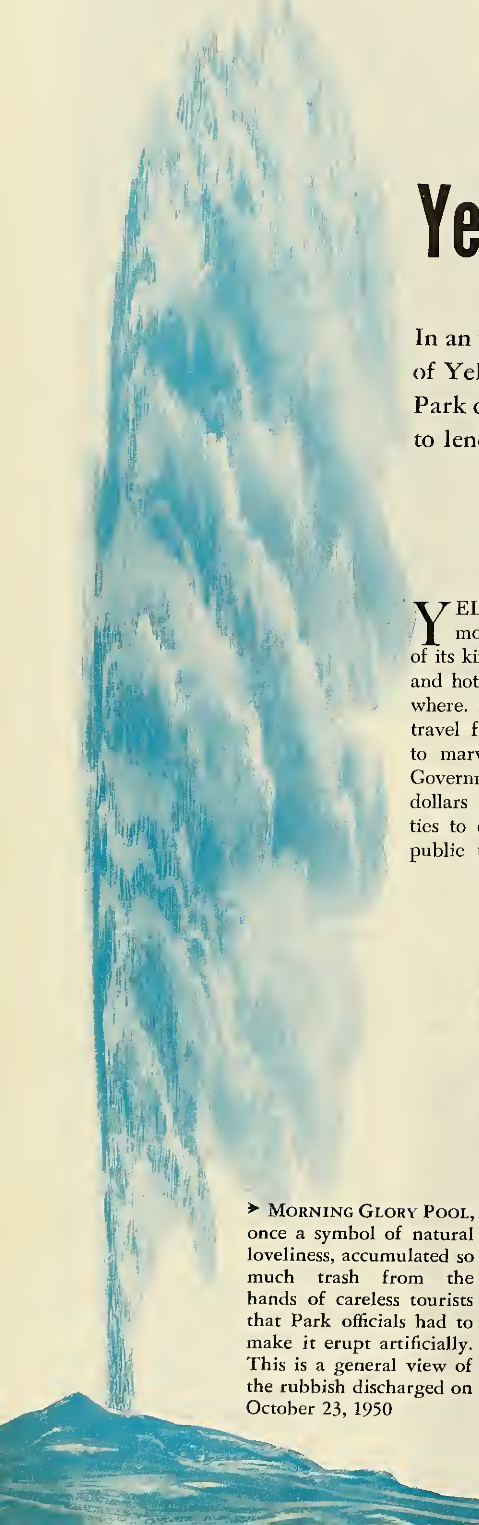
[*] Dr. William Jameson was still living and still collecting when the botanist Richard Spruce visited him in Quito in 1858. "He is a tall, ruddy Scot," wrote Spruce, "on the shady side of 60 years . . . most amiable of men, an ardent collector. . . But what can a poor fellow do who has had a drunken wife and (worse) a wife hanging on him for 40 years, who burns his dried plants whenever she can get hold of them so that he can keep no herbarium, and who has often had to struggle with absolute want." William Jameson was the author of "*Synopsis plantarum aequatoriensium*," published in Quito, 1865, in two volumes.

WHO is choking Yellowstone's Geysers?

In an uneven struggle between beauty and vandalism, many of Yellowstone's hot springs have already been stilled. The Park officials are doing all they can. It is time for the public to lend a helping hand to admonish the thoughtless visitor

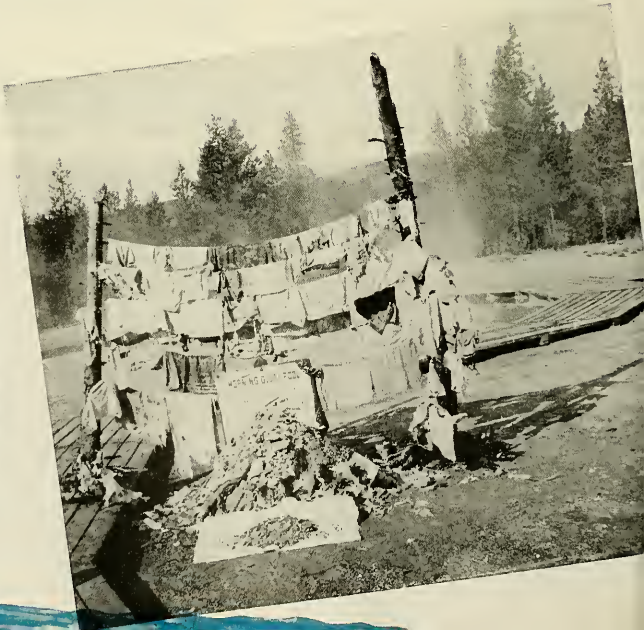
By George D. Marler*

All photographs by the author



YELLOWSTONE PARK is the most spectacular wonderland of its kind in the world. Its geysers and hot springs are unrivaled anywhere. Princes, kings, and savants travel from all parts of the earth to marvel at them. Our Federal Government has spent millions of dollars for roads and other facilities to enable the great American public to behold these matchless hydrothermal wonders. Yet, the great American public is ruining them—choking them simply because some people can't resist the temptation of throwing tons of assorted trash into the funnels of springs and geysers.

How, the law-abiding citizen



➤ Morning Glory Pool, once a symbol of natural loveliness, accumulated so much trash from the hands of careless tourists that Park officials had to make it erupt artificially. This is a general view of the rubbish discharged on October 23, 1950 may ask, can anyone visit Yellowstone Park without feeling some of the awe that stirred John Colter when he discovered the area in 1807, or the Washburn Party when they entered the upper Geyser Basin in 1870 and named Old Faithful? The myriad pools and mighty fountains so enchanted these latter explorers that their desire for their preservation found expression two years later in the establishment of Yellowstone as a National Park. It was the first time in recorded history that a government had set aside a tract of earth for the specific purpose of preserving its original loveliness.

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* George D. Marler is Senior Naturalist in the Old Faithful District.—Ed.

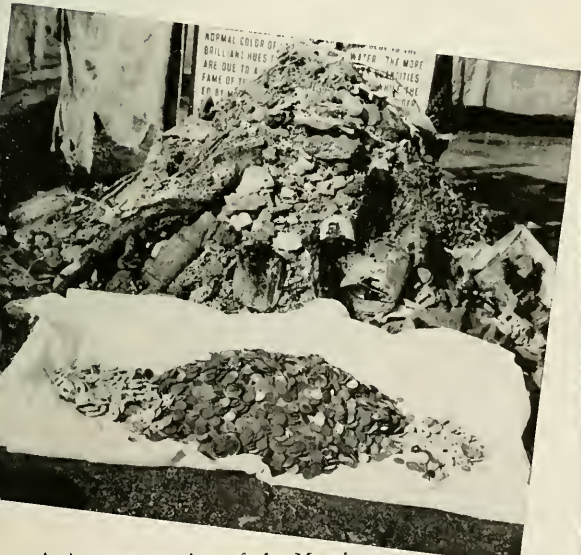
Only recently have Park officials seen to what extent vandalism can be carried. From a few saddle parties in the early '70s, attendance in Yellowstone has mounted to more than a million visitors annually. It is a sad commentary on our culture that when thousands of people find themselves with sufficient vacation time to visit the Parks, they are lacking in the most rudimentary conception of the educational significance of these natural wonders or the spiritual ideals that caused them to be set apart.

Tons of mineral specimens picked up on or about the hot springs—some of them pried loose from the mounds—leave the Park each season in the pockets of thoughtless or insensitive visitors. Photographs taken by William H. Jackson in the '70s, compared with the same subjects today, show that Old Faithful, Castle, and Turban Geysers have been deplorably mutilated. Many others doubtless would show similar disfigurement if pictures had been taken.

Shocking as it is, the removal of mineral deposits cannot compare with the damage caused by throwing knickknacks and rubbish into the hot springs. This type of vandalism has destroyed a number of hot springs and threatens all of them along the pathway of the visitor. It may be the special failing of children and teen-age boys, but many adults never outgrow the juvenile tendency to want to throw stones or other objects into the water. Since people first began visiting Yellowstone, a stream of rubbish of every description has been going into the craters of hot springs. The more popular and more frequently visited ones have suffered the greatest abuse. The famous Handkerchief Pool was rendered functionless over 20 years ago as a result of having its small vent deliberately plugged with a section of a tree and miscellaneous rubble.

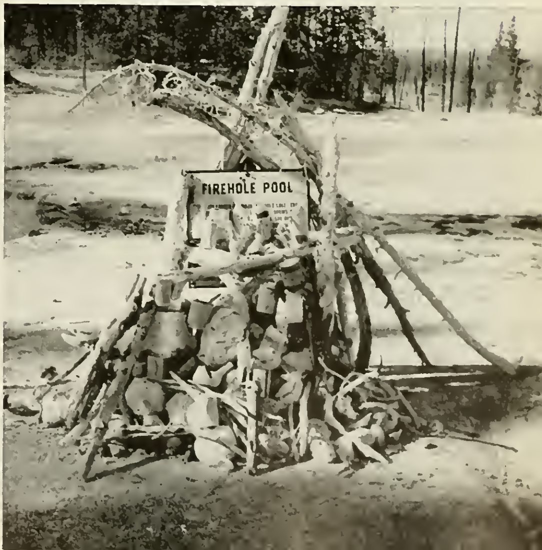
In its pristine clarity, the gem-like water of a beautifully tinted hot spring presents the visitor with a new kind of loveliness. Here, one says, is something so ineffable that only nature could have created it. But a rude shock is in store for the visitor who looks down into this masterpiece of nature today. Reposing in the bowl and on the shoulder is a great array of extraneous matter ranging from coins, beer cans, and pop bottles, to boulders and trees.

Let's trace the public's treatment of Morning Glory—originally one of the most beautiful wonders in the Park. Owing to its popularity, it is visited by practically everyone entering the Park. Early photographs of Morning Glory show that the Pool was originally bordered by a delicate, scalloped incrustation of



▲ A CLOSE-UP view of the Morning Glory rubbish. It included over $86.00 worth of pennies, and other coins from as far away as New Guinea

▼ SHOCKING as is the amount of rubbish that was removed from Firehole Pool, it is only a fraction of what can still be seen in its crater. The ever-boiling water makes removal difficult



geyserite. Today, there is no semblance of any such formation. Souvenir hunters completely denuded the border many decades ago. And when Morning Glory was induced to erupt during a clean-up campaign in October, 1950, it discharged 112 different *kinds* of objects. This was only a small fraction of the debris lifted by the water column. Most of it fell back into the pool.

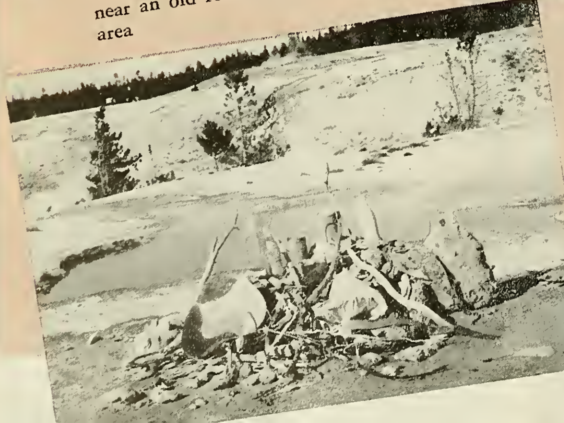
The hordes of unsupervised visitors have subjected Morning Glory to greater abuse than any other hot spring. Originally it was a symbol of natural loveliness. Today, depending upon the point of view of the observer, what one sees in Morning Glory educes either curiosity and morbid interest or a feeling of revulsion and indignation. The deeply-seated debris is not seen by most visitors, but the whitened ledges, once made brilliant by refraction of light from crystalline water, now are brown and copperish. The copper color is due to the reflection of light from seemingly innumerable pennies. Coins of larger denomination and many tax tokens contribute further to the disheartening effect. Mingled with these discs is a mixture of trinkets from pockets and purses of persons too parsimonious to follow the monetary urge.

With the purpose of recapturing some of her earlier beauty, Morning Glory was induced to play. Reduction of the hydrostatic pressure was the means, and the job was carried out by the author with the co-operation of the Naturalist Department, under David de L. Condon. Several thousand gallons of water were discharged and with it some of the rubbish. The amount, small as it was compared to the total, gives a clear picture of the vandalism to which this pool has been subjected. Coins from as far away as New Guinea; $86.27 in pennies, $8.10 in nickels, dimes, and quarters; tax tokens from 9 states; 76 handkerchiefs; 4 kinds of cartridges; nails (various sizes up to 20-penny); beer cans; an engagement ring; cigarette packages; and various objects too indelicate to mention bear witness to the reverence of the richest nation on earth for one of nature's most sublime spectacles.

Since the close of World War II, travel in Yellowstone Park has more than doubled over prewar years. We must realize that the impact of so many people is bound to defeat, in some measure, the ideal that lay back of the establishment of the Park. Roads and buildings to accommodate the public might be said to conflict with the idea of preserving the full pristine beauty of the landscape. Owing to Yellowstone's isolation, these have been deemed necessary accessories. However, vandalism in the geyser basins has increased out of all proportion to the number of

▲ UNSIGHTLY DEBRIS at an unnamed spring near an old road camp in the West Thumb area

▲ BOTTLES, beer cans, and the like, removed from Broken Egg Spring, illustrate the disgraceful misuse that has occurred among many hot springs lying along the pathway of the visitor in Yellowstone Park



◄ ONE SEASON'S RUBBISH removed from Blue Star Spring, Old Faithful's nearest neighbor visitors. Many entering the Park apparently care more about acquiring a Park sticker, to show how far they have traveled, than witnessing an eruption of Old Faithful.

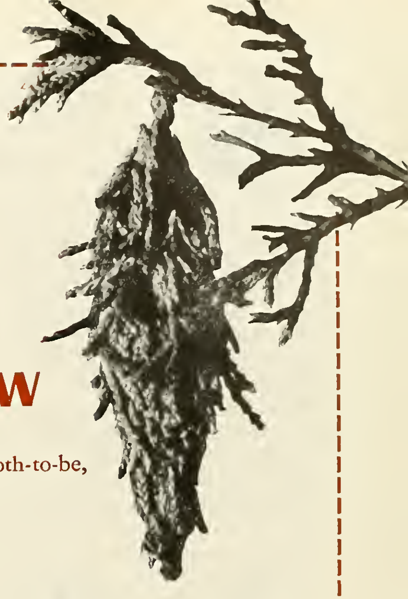
Boy Scouts, Future Farmers, etc., are now visiting Yellowstone in ever-increasing numbers, and many of these groups conduct themselves commendably. All too often, however, even in the best-disciplined groups, the boys break up into unorganized packs and mischievously roam the basins. Reminders of their visit are strewn along the pathway—geysers and hot springs choked with material the Creator never intended to be there.

The mineral that is deposited around the mouths of the springs and pools also accumulates around objects thrown into them. This hastens the deposition of the mineral and shortens the life of the geyser. Indeed, the visible rocks and other debris that have been thrown into the crater of a hot spring are of but minor importance compared with the irretrievable rubble that has found its way deep into the spring's throat. During the short period the hot springs have been subjected to vandalism, a number of the smaller ones have already been destroyed—their pipes filled with rubble, completely shutting off the escape of water.

This has to stop if the American public is to have anything that it can be proud of in Yellowstone Park. Already there are quantities of debris that can never be removed. The Park Service cannot put a guard over each pool. Shortage of appropriations made it impossible last year to install seasonal protective rangers in the geyser basins until July 1. About a quarter of a million persons had entered the Park by then. Besides, the Park Service has always wanted the public to feel as free as possible and to get close to nature without the need of signs and supervision.

Can't we find enough pride in this wonderland of ours to deserve this freedom and put an end to this destructive nonsense?

The Bug in the Built-on BUNGALOW



A part of the tree? No, a moth-to-be, well camouflaged

By J. R. Clawson

IF you are standing beside a tree some morning and a bundle of sticks and twigs suddenly gets up and starts to walk away, don't be too alarmed. Your eyes aren't deceiving you at all. It is probably only a bagworm on the run.

The bagworm is really the larva of a *Psyche* moth—all dressed in a sleeping bag of silk, adorned and camouflaged with small pieces of its natural surroundings. The larvae live in these tents while they transform into pupae. After the change is made, they often walk about—with only their heads peeping out—dragging their houses along behind them.

Building these houses over their bodies isn't as difficult as it would seem. The creatures merely cover themselves with silk and then chew up small pieces of leaves or twigs and deposit this material about them. Another loop of silk at the top is fastened to a limb. When they hide in cedar trees, they strongly resemble cones. As shown in the illustration above, bagworms are difficult to detect at first glance, and this affords them protection from would-be assassins.

Should the larvae be placed in a cage where natural twigs and bark aren't available, they will settle for substitute clothing. They have been known to use cork, broom straw, stones, and paper in an effort to hide their identity.

What happens next depends to some extent upon whether it is a male or female bagworm. The male larva quite conventionally pupates in the bag and emerges from the pupa as a winged creature. But you might not recognize the adult female as a moth at all, for she is wingless and legless. In some bagworms the female is so "maggot-like" that she can be identified as a moth only by an anal tuft of hair-scales. She may, in some species, never leave her pupal shell in the bag. She is inseminated there by the male. She may then leave the pupal shell to lay her eggs in the vicinity, or she may merely pack them in the old bag and die there.

Primitive species of bagworms have rather more normal, winged females. The bag shown here, however, probably belongs to the Evergreen Bagworm (*Thyridopteryx ephemeraeformis* Haworth), which commonly contains a wingless female, and she may perform her reproductive duties without "leaving the house" from birth to death. This bagworm is at times a bad pest on ornamental trees and shrubs.

A glimpse behind the scenes at one of the world's strangest industries—a bee farm that does not produce honey

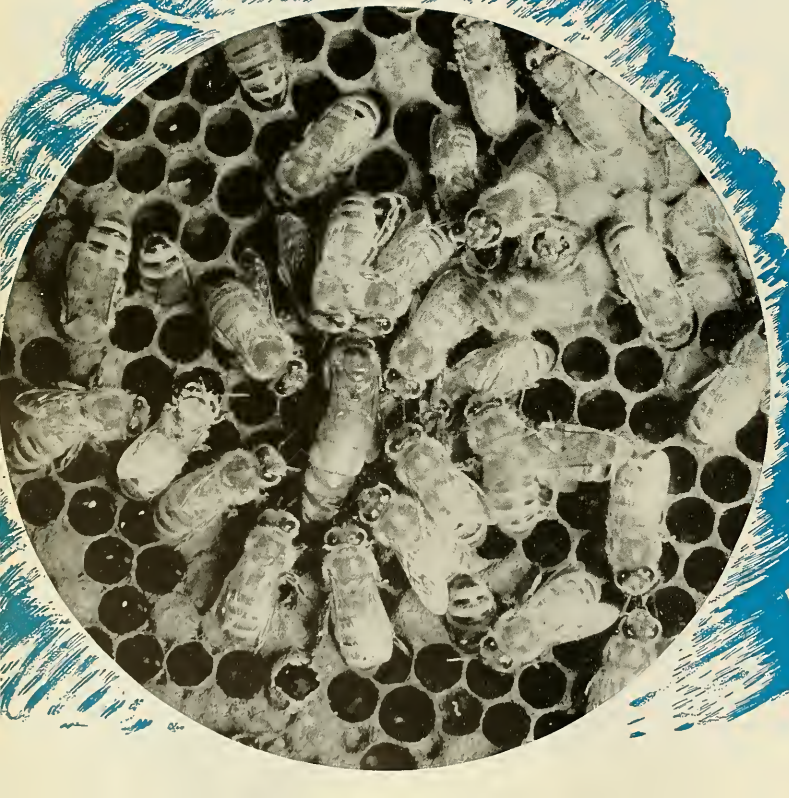
AT the whistle-stop station of Mayhew, Mississippi, is found one of the world's strangest industries. Mayhew is no different in outward appearance from a thousand other small communities scattered over the Southland. Great oaks line its only street, where potlicker hound dogs laze in the sun and happy Negro children lick contentedly on all-day-suckers. There is a church and, across the railroad tracks, a typical country store which stocks everything from nails to molasses. As usual in southern rural communities, this store is the hub of life, and soda water and tall tales flow freely during the long, hot afternoons.

Nearly 40 years ago, D. D. Stover came to Mayhew from Virginia to establish the Stover Apiaries—which, in all that time, have produced no honey! This may seem paradoxical, since apiaries are usually thought of as "honey farms," but, strange as it seems, Stover's produces and sells only pure-bred Golden Italian honeybees and queens. The hives are managed in such a way that the nectar and pollen from the fields are converted into bees rather than stored food, and Stover's has become one of the largest "Queen Farms" in the world. Nearly 100,000 pure-bred

Southern Queens
for the honey world

By Ross E. Hutchins

All photographs by the author



< A QUEEN at the center of her retinue of workers. She is the mother of all the bees in the hive, and of the future bees in the hive as well. She may lay as many as 2000 eggs a day at the height of the egg-laying season. She mates only once but lives and produces fertile eggs for two or three years. Since the workers live only about six weeks during the summer, a new, pure-bred queen will be the mother of all of the bees in the hive at the end of six weeks

queens were shipped from Mayhew, Mississippi, alone last year. They bring about a dollar each on the world market.

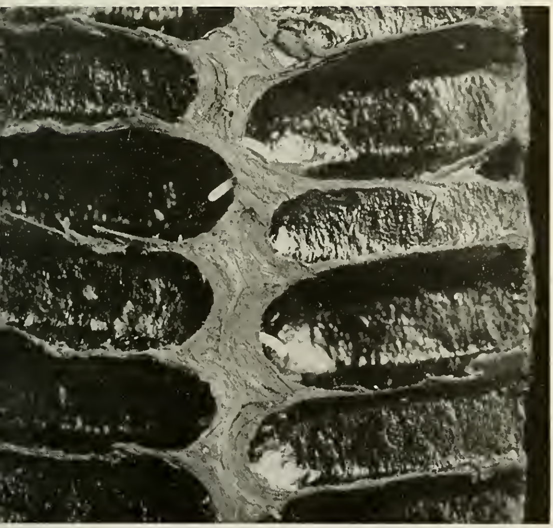
Northern beekeepers soon learned that the strength of their hives could be built up quickly for the honey flow by buying package bees and queens from the Deep South to replace bees lost by winterkill. The result was that they beat paths to southern apiaries to purchase two- and three-pound packages of the buzzing hoard.

As the years passed, orders for pure-bred queen bees began to come in from the far corners of the earth. These queens, each in an individual cage with a half dozen attendant workers, now go by air in a steady stream to Italy, France, England, Ireland, South America, Central America, Japan, and in former years to Poland and Russia.

The technique of producing thousands of queen bees is complicated and is known to only a few skilled keepers. As most people know, only one queen lives in a hive. If two queens should "hatch" at once, there ensues a battle to the death of the weaker. The only time the queen uses her sting is during this royal combat. The means by which thousands of queens are produced and still have only one adult queen to a hive at any one time is portrayed in the accompanying series of pictures.

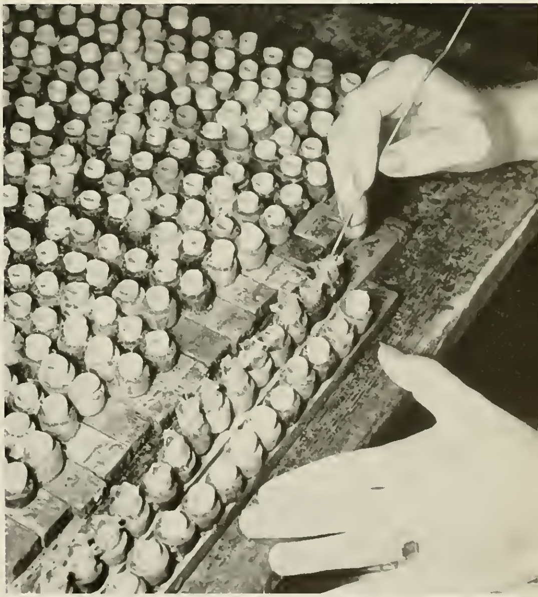
The importance of pure-bred queen bees rests upon a little-known biological anomaly. Of all the bees in a hive, the queen is the only one that lives more than a few weeks during the summer. Her life span may reach six years, but two or three years is the average. Now, suppose a beekeeper in South America has hives of the so-called black German bees and he wishes to change over to Golden Italian bees, which have many desirable characteristics. How does he change over?

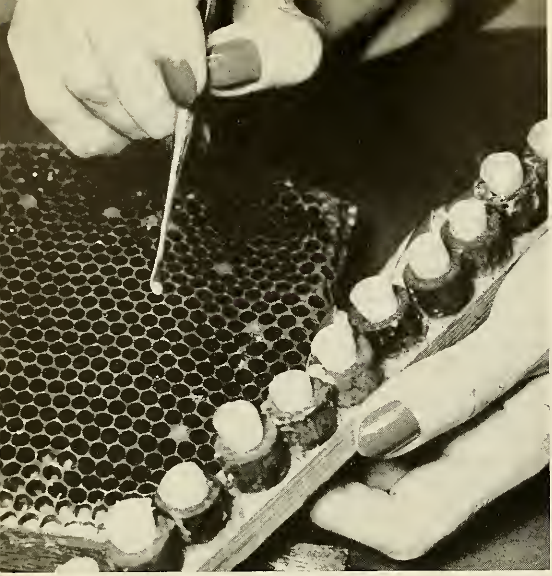
The technique is very simple. He just orders pure-bred queens, one for each hive, from a queen-breeder. When they arrive, he kills the black queens and introduces a golden queen into each hive. Remember that she has already mated with a pure-bred drone before being shipped. The new queen begins to lay eggs almost at once, and soon these hatch and develop into workers—not black workers but Golden Italian workers, for they are her children. As stated above, the worker bees live only five or six weeks during the summer working season. Thus, at the end of that time all the bees in the hive will be pure-bred offspring of the golden queen. As simple as that; yet it is the basis for an extensive and interesting industry.



▲ THE QUEEN lays one egg (a small, cylindrical object) in each cell, as this cross section of brood comb shows. Both workers and queens result from fertilized eggs; drones from nonfertilized eggs. If the young larvae from fertilized eggs are fed "royal jelly" throughout their larval life, they will develop into queens; but if their food is changed to pollen and honey after about three days, they will become workers. "Royal jelly" is secreted by the adult worker bees

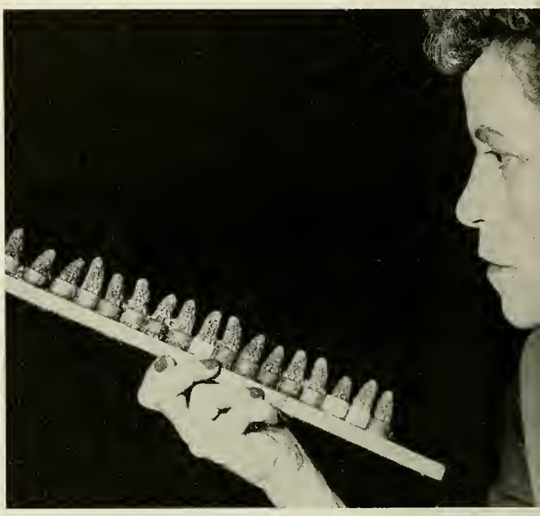
▼ HERE a technician transfers, by means of a spatula-tipped instrument, a small amount of "royal jelly" to artificial wax starter queen cells. This start of "royal jelly," when placed in the oversized queen cells, will induce the workers to continue to stock the cells with the royal food



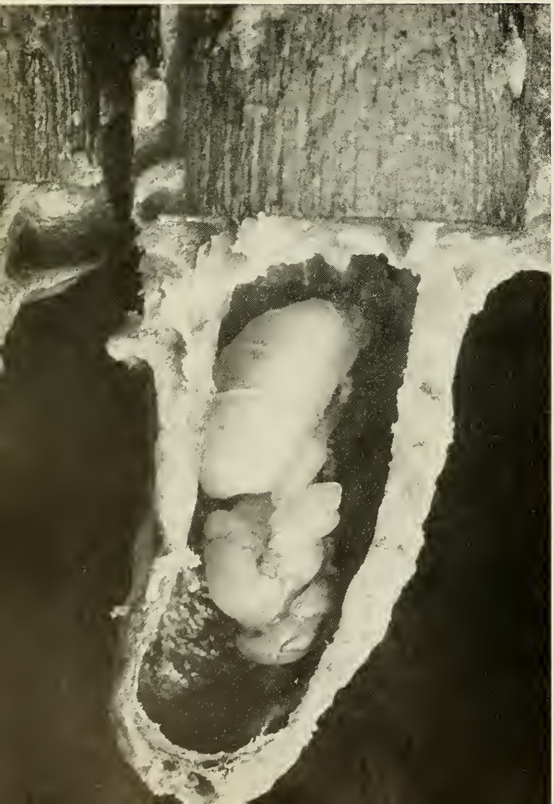


◂ AFTER the artificial starter cells are stocked with "royal jelly," a young larva is "grafted" into each one. These bars containing their rows of starter cells are now placed in strong cell-builder hives, where continuous feeding with the royal food will cause them to develop into queens

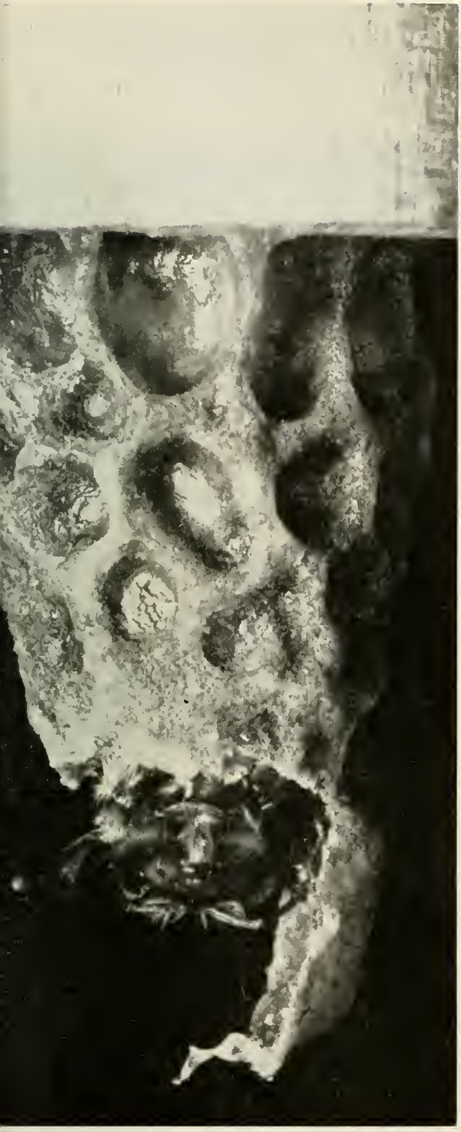
▾ IN LESS THAN A WEEK, the cells containing the young queens have been fully formed and capped. Each cell now contains a queen in the pupal or resting stage. The bars of cells must now be removed from the cell-builder hives, since they must be separated from each other by placing each in a separate little hive called a "nucleus." If the queen cells are not thus separated, the first queen to emerge will open and kill all of the rest. She is an uncompromising "ruler" and will tolerate no other queen in the hive

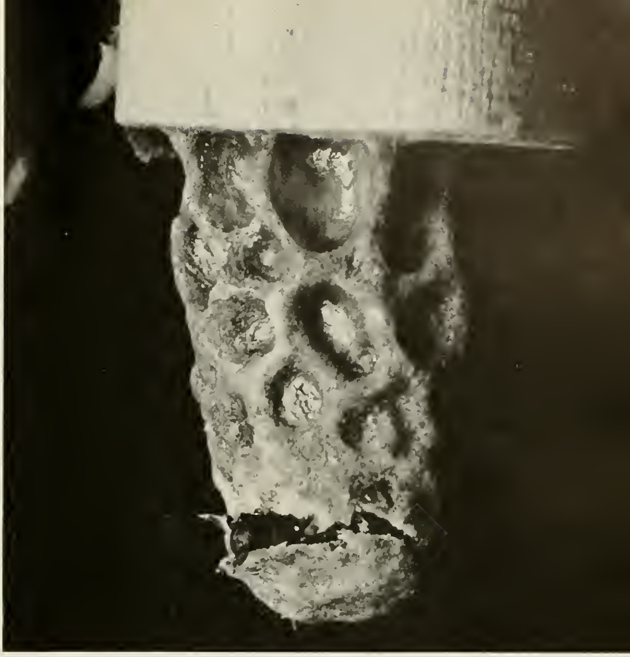


▾ FOR SEVEN AND A HALF DAYS, the developing queen sleeps the "sleep of transformation." She stands on her head, as this cutaway picture shows. During this period, she transforms from a legless larva to the pupal stage. Developing legs and wing buds are now in evidence



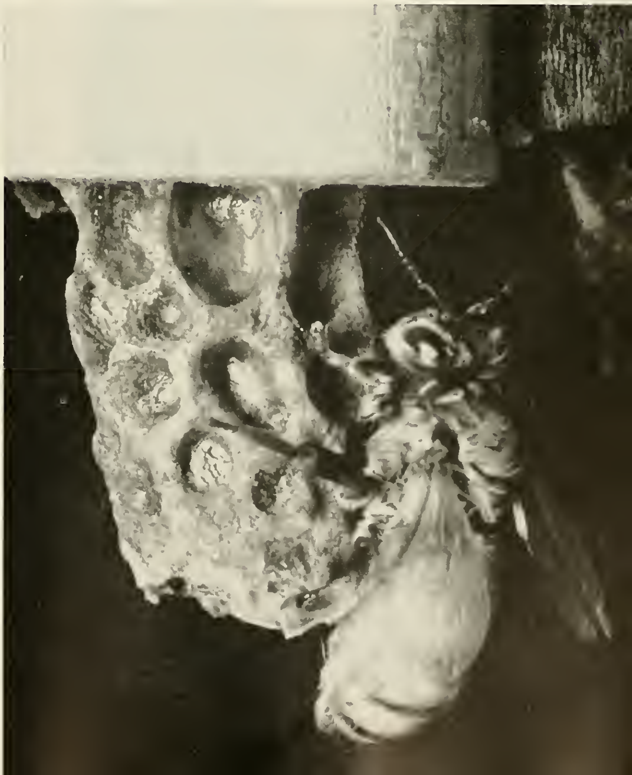
▾ BEFORE THE QUEEN EMERGES, she is placed—still in her cell—in these "nucleus" hives. Here she emerges from her cell, goes on her nuptial flight, and settles down to "housekeeping"





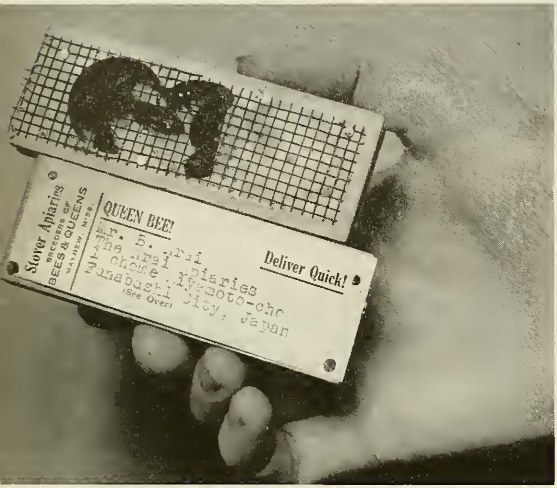
⮝ At the end of the seven and a half days required for the completion of her pupal stage, the queen begins to chew the lid off of her cell. During this process she rotates about, cutting the lid with her mandibles

⮝ Here the lid is open, and we see the head of the queen emerging

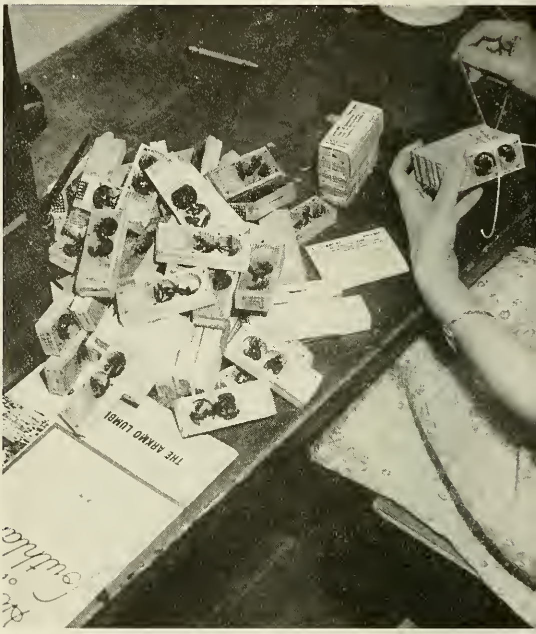


➤ The queen has emerged and is damp and bedraggled. Soon she will go on her mating flight, after which she will return to the "nucleus" hive and begin laying eggs

◀ **After the young queen** has mated and laid eggs that have proved to be fertile, she is ready to be placed in a small, wooden shipping cage. With her go a half-dozen worker-attendants to care for her on the journey



◀ **The queen** and her retinue of workers in their wooden cage have a supply of sugar candy for the trip. Destination: Japan



▲ **Queen cages** are tied together in groups according to destination and are then shipped by air to the far places of the world. These are destined for Poland, France, and the West Indies

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BOUSSINGAULT—SCIENTIFIC ADVENTURER

Continued from page 275

after ten years of exploration, he had then a more intimate knowledge of Venezuela, its llanos and mountains; of Colombia, with all its varied geographical patterns; and of Ecuador than any man who had ever lived.

After many adventures, which he relates with the skill of an accomplished littérateur, Jean Baptiste Boussingault retraced his way through Colombia and spent enough time to pack the collections he had made over the ten years of his residence. Then, on July 11, 1832, he sailed for home.

He was showered with honors on his return to France. He was elected Professor of Chemistry at the University of Lyon, made a member of the Academy of Science (Humboldt himself reading his eulogy), and honored by the Institute of France—all of which distracted him not a side-whisker from his great work, long in preparation, on soil chemistry. But he *was* distracted by Adele Lebel, whom he called *"Une petite fille demi-sauvage,"* and they were married in 1835.

Then politics. In the wave of the rising sentiments of republicanism, Boussingault formed with other scientists the Lyon section of *L'Association des Droits de l'Homme,* and when the revolution of 1848 occurred, Boussingault played his part in it and as a result was elected a deputy of the constitutional assembly. But he was prodigiously self-willed, and he would have gone to the stake for an idea. He tried to stir his colleagues out of their political apathy and succeeded all too well. The stirring was too brisk, and Boussingault was tossed out. Although he was strongly defended in scientific circles, he now tossed politics aside and retired to his estate—given obligingly by his father-in-law—at Lobsann, in the shadow of the Capuchin monastery at Liebfrauberg in the Bas-Rhin section of France.

There he carried out an elaborate series of controlled experiments on the chemistry of fertilizers. Boussingault's house, with his attractive "*demi-sauvage*," Madame Boussingault, in attendance, was a hostelry for the learned. And since he was a man of wit, of taste, and of learning and so capable of feeling and imagination, his presence drew to him all the savants of his time. Then, as all life is but a succession of partial deaths, Boussingault's good fortune was partly drained before its time, for in 1877 his wife died. He was much affected by her passing. He gave up almost everything, retired to his hermitage at Liebfrauberg, and would have withered away had not his scientific friends urged upon him the task of writing his scientific memoirs.

Once Boussingault embarked upon the sea of his confessions, he had a merry time. He said, "I have always placed my prejudices above my convictions," and, having attained the age of 85 and passed the reach of malice or resentment, he wrote his memoirs as no other scientist had written before him—a document frank, revealing, and engaging, at turns piquant and ribald, his language abounding in picturesque images and freshly minted expressions. He cast aside restraint as an encumbrance, for as the memoirs were not intended to be read outside of his circle, the charming old gentleman turned all his wit, self-examination, and human philosophy to the task and allowed everything to bubble forth.

After his death in 1887, his daughter, stirred by filial piety, watered down the racy memoirs by inserting into them details drawn from his scientific papers and by filling the appendices of each volume with his earlier correspondence.

They were published on handmade paper in Paris between the years 1892 and 1903. The printing was limited to only 300 sets, and they comprise one of the rarest documents passed down to us from an explorer who made scientific history on two continents.

BOOKS

Continued from page 247

in *Brown Men and Red Sand.* He has done so in terms of an expedition to their country, giving us in one account the trials of the European visitor, the nature of the terrain, and the character of aboriginal life. Many scientific treatises have been written about the Australian aborigines, but they tend to create a depersonalized picture of the people themselves. It is Mr. Mountford's virtue that he writes of his aboriginal friends as human beings.

HARRY L. SHAPIRO

HEARTH IN THE SNOW

by Laura Buchan and Jerry Allen

Wilfred Funk, $3.50
306 pp., 22 illus.

THE jacket of this true account of teachers in an Alaskan village inevitably labels it a "heart-warming story." Although the book has its share of sentiment, of an attempted reproduction of Eskimo-Aleut dialect that does not sound quite right to an old Alaskan (but is not too bad), and of incongruous metaphors, it also has dramatic passages, real sympathy, and an occasional figure of speech that is original, yet exactly appropriate. Description of spring coming to the tundra, of illness in the village when the radio is dead and one cannot get help, of tremendously varied community life enacted in the schoolhouse give sensitively the feel of these experiences in a small and isolated village on Bristol Bay in west Alaska.

Laura and Bill Buchan went there after World War II as new employees of the Alaska Native Service, a segment of the U. S. Department of the Interior. Laura taught school, Bill was postmaster and amateur radioman. They seem to have understood the native ways better and to have developed a more genuine mutual affection with the local people than do most new teachers. The book, which apparently was written in final draft by Jerry Allen, a newspaperwoman, from letters sent her by Laura Buchan, becomes at times too much a woman's story. Especially in the first half of the book, Bill Buchan's place in the community is scarcely acknowledged, the tone wavers from sunshine-sweet to tearful in—dare we say?—a feminine way, and "the school mamma" tends to be moralistic. She is, however, moralistic about the right things, in the view of a student of Alaska's struggle to get itself educated and organized for modern life. Also—this should reassure both men and women readers—she is not afraid to go outdoors, her anecdotes are good, the story has more plot than most reminiscences, and it moves rapidly. It has passed the real test: it is recommended to Alaskans as well as to Outsiders.

MARGARET LANTIS

THE FOUR SEASONS OF MANUELA
by Victor W. von Hagen

If you have enjoyed the scientific adventures of Boussingault in the pages of Natural History—

If you want to meet more of him as provided in the secret history of Manuela—

You will find him in the pages of THE FOUR SEASONS OF MANUELA.

Who was Manuela Saenz? Every biographer of Simon Bolivar up to now has alluded to her, fictionalized her, drawn her vignette in distorted lines. But now Victor W. von Hagen—whose vibrant pen has brought South America to life as it has never been done before—brings you this secret history of the mistress of Simon Bolivar. It is not alone one of the most intimate romances yet recounted but is a history of the history-makers themselves.

THE FOUR SEASONS OF MANUELA A Biography. $5
At all Booksellers
Duell Sloan and Pearce, New York
Little Brown and Company, Boston

Three scenes from "The Ivory Hunter"

The Screen

Authentic comments on films in the field of nature, geography, and exploration

Edited by Elizabeth Downes

IT is beginning to look as if 1952 might be called African Film Year. This month Natural History reviewers saw two feature presentations, both of which were filmed in Africa. Both are primarily concerned with Africa's large mammals, and the technicolor photography in each of them is excellent. "Ivory Hunter" was selected for the British Royal Film Performance in 1951. Inspiration for the plot of "Ivory Hunter" came from the story of Colonel Mervyn Cowie, who by sheer perseverance and belief in his idea created the Royal National Parks of Kenya for the preservation of African game. "Tembo," while it has some beautiful shots of African wildlife, has quite another theme. It shows the African safari of Howard Hill, who goes around demonstrating that the large mammals and snakes of Africa can be killed with the bow and arrow.

Anthony Steel and Dinah Sheridan star in "Ivory Hunter." The film was produced by Michael Balcon and written and directed by Harry Watt. It is being released by Universal-International this month.

We have obtained the expert opinion of Dr. James P. Chapin of the American Museum's Bird Department, who has lived in Africa for over eight years and been a student of its natural history most of his life. Commenting on "Ivory Hunter," he says:

"Over a year ago we had the pleasure of meeting Colonel Mervyn Cowie in New York and hearing from him about the new system of National Parks in Kenya Colony, of which he is the first Director. Since then he has sent us his admirable Report on these Parks.

"In order to establish such parks and to keep them inviolate and adequately financed, it is essential to arouse public enthusiasm. For many years, the Kenya Game Department was kept going by license fees paid by visiting sportsmen, and it is to be hoped that in the years to come the National Parks will attract tourists and friends of nature in such numbers as to provide considerable revenue to the Colony.

"This film, when shown first in Great Britain, was entitled 'Where No Vultures Fly,' with the aim of suggesting that when the slaughter of game ceased, these birds would no longer be seen circling in the sky. It is a J. Arthur Rank presentation and is frankly offered as propaganda in favor of the Kenya National Parks. Although dedicated to the pioneer work of Colonel Cowie, the script is fictional, and Robert and Mary Payton really have a very tough time in policing the first National Park, in plain sight of the snowy dome of Kilimanjaro, with next to no support from the Government beyond permission to occupy the ground.

"The villain, Mannering, is secretly buying ivory from native hunters in the area and smuggling it across the border. He, of course, wants no Park and is willing to do anything short of murdering the Paytons to destroy it. He bribes the natives, encourages their elephant poaching, and eventually is killed when his car leaves the road and plunges down a mountainside. So the Paytons win out, but only after many narrow escapes—from a lioness, rhinos, a wounded elephant, a Kawamba spear, and a furious leopard.

"These gripping adventures are interspersed amid marvelous film sequences of the big game for which East Africa is so celebrated. The views of elephants are exceptionally fine, those of giraffes, rhinos, lions, and a great variety of other animals splendid. The actors, both white and black, give perfect performances, and the sound recording, of speech especially, is particularly faithful and convincing.

"'Ivory Hunter' is truly one of the great color films of African life. Its intensely dramatic quality would seem to assure an enthusiastic reception in the United States, and as propaganda in favor of game preservation and National Parks it could scarcely be improved upon. For my personal taste, I must confess, the adventures are almost too fast and furious; I should like more time to enjoy watching the animals."

"In the film 'Ivory Hunter'," says George Goodwin, who has also traveled in the interior of Africa and is an Associate Curator of Mammals at the American Museum, "I had the pleasure of seeing one of the best game pictures that has come out of Africa in recent years. Not only is it exceptional in a wealth of subjects and color photography, but it has a definite purpose that is put over with tact and skill. It creates a sincere feeling of disgust for the ruthless slaughter of wildlife that is going on under the guise of big game hunting. Here is a dramatic story filled with thrills and packed with stirring adventure without any gory details. It is as far from a lesson in conservation as it is from a study of natural history, yet one is left with a very real personal interest in the great creatures of the African veldt and with a sincere desire to protect them.

"Wildlife is perhaps a little overdone in places, which could be misleading. Animals are not up all the trees, nor do you find them around every corner in East Africa. The emphasis on the concentration of game, however, serves a purpose. The picture first takes us through the miles and miles of empty plains that have been ravished by the ruthless exterminators. From here we see in contrast the Eden of a natural wildlife reservation where game laws are enforced and wildlife has responded liberally to protection.

"The Park Director's boy has perhaps rescued a few too many pets, but they represent the young of slaughtered mothers. I would not recommend that anyone try to acquire a tiny lion cub with the lioness close by as does the boy in the picture; the consequences are more apt to be sudden and fatal.

"The picture is well worth seeing if only for a great herd of elephants out on the baked mud of a dry lake. To me this awe-inspiring sight is the climax of the picture. It instills a strong feeling of resentment against the ivory hunter, the traders, and the prevailing laws in America that permit the shameful importation of ivory—the world's greatest and now glutted market."

"The hunter who is depleting the fauna of Africa is interested chiefly in big game which includes mainly the large mammals, so that this film just briefly brings the reptile into the picture," says Mrs. Bessie Hecht of the American Museum's Department of Herpetology. "But any depletion on one part of the fauna will eventually affect the whole ecology of the region. Because of their immediate economic value, it is difficult to convince the public that the large mammals should be conserved. It is even more difficult to point out the need to include reptiles in a conservation program, because of their lower economic value and because of the superstitions and fears that universally surround them. Even in this movie, the snake, supposedly a cobra, was killed while trying to escape from the bush camp in the National Park. Apparently the zeal for conserving the fauna had not yet included snakes, although one scene shows the Park Director's son, Tim, playfully adding man-made coloring to the gaudy skin of a chameleon, a less objectionable reptile."

"AFTER seeing the motion picture 'Tembo,' one can only wonder what was the intended purpose of this film unless it is supposed to prove that the hunter can shoot with a bow and arrow," comments a well-known African explorer. "The entire picture is based on chasing a lot of harmless game, often to exhaustion, with an automobile over the African veldt. There is scarcely an instance where the animals are shown at ease and behaving in a normal manner. Most, if not all, the big game pictures were taken in the Tanganyika wildlife parks and other reserves. While there are admittedly many colorful and picturesque scenes of big game here, any merit that the film might warrant is overshadowed by faulty editing and a desire to make a safe and comfortable sojourn in Africa appear to be a gory and dangerous mission. Danger does not lurk around every corner in Africa. You must look for and make your own trouble if you want it. Buffalo, lions, and elephants are among the first to seek safety in flight at the approach of man. The pictures of the Cape Buffalo may well have been taken in the Albert Park where they are quite tame, which may explain why they did not run when approached by the automobile.

"Almost any high school student could put the film editor right on such errors as saying that the giraffe has no vocal cords or that the elephant is the largest of all mammals.

"It is perfectly obvious that the baboon is not a ferocious killer or a dangerous animal. It is an amusing creature that feeds on fruits, seeds, insects, and the like. Minding its own business, a baboon's first action on the approach of man is to retire to a safe distance.

"Time and again, scenes of Tanganyika game reserve animals are shown in the forest of the Belgian Congo, and we find animals here that do not belong in this locality.

"The aardvark is a nocturnal animal and yet it is shown, without explanation, out in broad daylight. Furthermore, the spring haas, a characteristic African rodent, is not only strictly nocturnal but brings forth its young in burrows underground, but here we find it nursing young in the tall grass under a tropical sun. The little animal referred to as a sloth was in fact one of the lemurs, commonly known as the potto, and a captive animal at that.

"When lion cubs are old enough to take meat, the lioness does not lug buffalo heads and zebra limbs to feed them. The cubs join the lioness when she makes her kill. Lions are not dangerous and ferocious creatures. They kill one or perhaps two animals a week and make off at the sight of a man on foot. The leopard is an exceedingly shy animal, more so than the lion, and will not stalk a safari.

"The killing of the leopard in the picture was a badly staged affair. The poor creature was not given a chance to escape. There is no excuse for such an exhibition of wanton cruelty.

"There are nearer 60 than 12 kinds of gazelles, and the impalla does not have the widest range of any animal in Africa. For example, the greater kudu is found from Ethiopia to South Africa.

"The killing of an African elephant was so grossly misrepresented that the entire section should be cut. I do not for one moment accept the supposition that the elephant was killed by an arrow. Such a shot, at the distance shown, would not penetrate to the heart and, if it did, would not stop a bull elephant. Rogue elephants are solitary and do not mix with the herd. Furthermore, a bull does not try to lead a hunter away from the cows and calves. Once alerted to the presence of a white man, an entire herd of elephants will stampede together clear out of the area.

"My experience with the pythons is that they are harder to approach than the game animals, and the two instances where pythons appear on the film were staged."

Here are the opinions of another authority on Africa.

"I can well believe that Howard Hill, who seems to be the hero, is an expert with the bow and arrow. He and his companions certainly traveled widely in the eastern half of Africa, and had with them some marvelous photographers and a good sound technician. The resulting film is beautiful and will no doubt provide great pleasure to audiences in America, yet one fact stands out: it gives a totally wrong impression of Africa today.

"One might easily gather that there is scarcely a paved road or up-to-date town in all tropical Africa. The search for the mysterious Leopard Men—they turn out to form a whole tribe—is pure fiction. The leopard societies of Central Africa are quite well known, and there was no need to go rolling all over East Africa, Uganda, and the eastern Congo to find out where they are. The 'Reverend Bigelow' was a poor guide indeed.

"The scenes in the film often bear no relation to the section of the map just shown on the screen. Geography is often completely jumbled. I do not know of any 'Kinkala' tribe in the Central Congo that has herds of cattle like those shown. The hunting of small forest antelopes by Pygmies with nets is very well filmed, but all through it there are scattered 'shots' of small East African antelopes scurrying from bush to bush, plainly to enliven the action.

"In some of the native dances, the costumes or ornaments seem greatly exaggerated in color; one seldom knows just where the people live who are being shown. Many of the scenes with great numbers of game animals are splendid, though one is never sure whether they were filmed on the Serengeti Plains, the Albert National Park, near the Victoria Nile, or in some other place unnamed.

"Thus 'Tembo' is likely to be widely acclaimed, to 'gross' a lot of money, and to teach the audiences very little that is correct about Africa. Now that there is every means—it would seem—to spread the truth about Africa, really to instruct our people, what a pity that the new films must be romances scarcely worthy of Rider Haggard."

"Tembo" was produced and directed by Howard Hill and was recently released by RKO Radio Pictures.

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LETTERS

Continued from page 242

realize that such things happen frequently.

J. M. Davis
Bausch and Lomb Optical Co.
Rochester, N. Y.

Natural History is happy to supply reprints of articles, reproduced by offset at cost. For the purpose requested by Bausch and Lomb, the article "Who Thought of it First" has been reprinted, and additional copies are available at 5 cents each to whomever may want them.

Articles appearing in Natural History are frequently requested in reprint form for classroom use or for purposes of public education in the field of conservation, etc. We are glad to fill such needs at the best current rate. Readers are encouraged to express their interest in this regard, and we shall endeavor to comply. The illustrations in the reprints do not always have quite the brilliance of the original half tone engravings, but they are satisfactory for most purposes. The initial cost is about $5 per page for the first hundred copies, but it decreases greatly on larger orders. —Ed.

Overgrazing and Floods

Sirs:

I was very much interested in your article "Cut or Let Grow." I am strictly for the conservation of our National Forests. Wise use of our natural resources is a thing that cannot be stressed too much. These forested areas maintain life on the land at lower elevations. No organism can live without water regardless of how much food is available. Therefore, destruction of our watersheds results in the destruction of our own civilization.

Every year many people are paying twice for unwise cutting practices. They buy the lumber to build a home and then reclaim their home after the annual floods. The destruction of the watersheds has resulted in disastrous floods, which destroy all of man's improvements and have already carried away much productive soil.

The trend of thinking seems to be that water impoundments can stop these floods and supply the water needed to produce crops. What good is a reservoir when it is filled with mud, which happens to be the productive soil of our watersheds? Protection of the watershed prevents floods through stabilization of the water flow and leaves the topsoil in place to produce the needed vegetation.

This is a little off the subject of your article, but here in the Rocky Mountains the forests produce much noncommercial wood. As a result, grazing of domestic livestock is the principal use made of the National Forests. I think this situation is serious and should be corrected immediately. The overgrazing has reduced the vegetation to annual and perennial weeds in far too many areas. This type of use has exactly the same effect as unwise cutting practices for lumber production.

The United States will face the same conditions that exist in Europe and Asia if the process continues long enough. Prior to the settlement of the western states, people could squander the natural resources where they were and then move west to new land. Now the most desirable lands are settled and the natural resources are very limited. As time goes on and the population increases, the resources will become more limited. This situation will result in intensive silvicultural practices, and the only fish that can survive in the mud-ridden streams will be carp. This is not a very pleasant situation, but it is present in many places in Europe and Asia. This illustrates the need for wise and conservative use of our National Forests.

As I write this letter, the radio has been telling about all the preparation being made at Omaha, Nebraska, for the record flood on the Missouri River. It would seem that the people in that area would realize the conditions that are greatly responsible for the flood and demand action to restore the watersheds and conserve our National Forests.

Homer V. Griffin
Paonia, Colo.

Sirs:

I wish to go on record as strongly favoring the preservation of our Forests in every possible way.

Surely it must be possible to conduct lumbering operations in other than National Forests so that long-term reforestation planning will take care of requirements. If better methods and less reckless waste cannot be practiced, the use of virgin forests will merely postpone the day when we will have to economize or do without. . .

Alexander Menzel
Mt. Vernon, N. Y.

Sirs:

I wish to enter my protest against the despoiling of our magnificent forest land. . . More power and success to you in your effort toward the conservation of the Forests we love so much.

Carl Schmidt
Pasadena, Calif.

Important Notice

Readers are reminded that Natural History is not published during July and August. Those who expect to be away after September 1, however, and wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary. Please give also the date of expected return to permanent address.

Birds & Bees
PH

Summer Naturalist

Our Common Butterflies

by F. E. WATSON and F. E. LUTZ

Science Guide No. 38, Price 45¢, postage 3¢

A general introduction, many illustrations, and a chart giving haunts, food habits, and life histories make this booklet an excellent reference for the summer naturalist.

August on Fire Island

by ROBERT C. MURPHY

Science Guide No. 134, Price 40¢, postage 5¢

Fire Island is one of the few remaining primitive nature spots near New York City. In his usual charming way, the author catches the beauty and serenity of this "entrancing territory" and describes the vegetation, animal life, and topography of the island.

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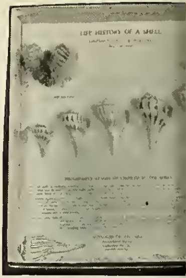
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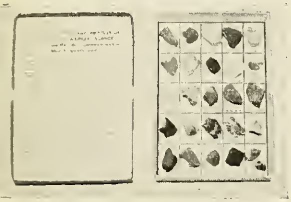

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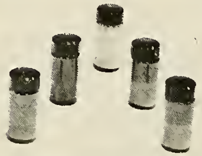

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Karl K. Krogue photo from Don Knight

Beaver pool near Banff, Mount Rundle in background

LETTERS

Keep America Beautiful

Sirs:

Commendations upon the fine issue of Natural History for May and especially upon the pointed prose of Annette H. Richards. It would be good if her article could be reprinted and distributed to every family that visits any public recreation area. Much of the "litterbugging" is ordinary American thoughtlessness or lack of vision in respect to the other fellow. Some, however, is no doubt due to that almost universal lack of training in appreciation of public affairs or plain courtesy. Some of it results from the peculiar notion that public property is the property of the public for whatever misuse enters someone's mind.

Your editing of Natural History has become a fine art—probably coupled also with much persevering toil. Again congratulations.

Arthur Bevan, *Geologist*

State Geological Survey Division
Urbana, Ill.

Sirs:

You don't have to go to the National or State parks to see the work of the Litterbug. Our home is on a corner, and I seem to be continually picking up papers, cans, and other debris cast aside by passers-by. . . .

It is past understanding how some people who normally may be respected citizens can be so filthy and destructive of public and private property.

L. F. Gose

Bay City, Mich.

Sirs:

The issue of Natural History containing the article on Litterbugs came to me this morning, and if I had hypertension, it would send my blood pressure to a dangerous point. The article told me nothing new about the vandalism of our people, but in my retired life, it so excited me with the horrors of our favorite pastime that I must write. I wish I could send this article to every school in the country, where a sympathetic, magnetic teacher should read it in class to impress the formative citizen. Training for a love of beauty, I feel, must have a humanizing, civilizing influence on our children, many of whom have not the opportunity of finding it at home. I almost dislike using the word civilized when civilization has taken such a destructive tendency everywhere. . .

If possible, please send this Litterbug article or excerpts from it to as many public schools as you can, with the request that it be read to the class by the teacher. For the printing of this, I enclose a check for $200, and please thank Annette H. Richards for her splendid contribution.

Mrs. J. M. Huber

Locust, N. J.

Sirs:

I wish to congratulate Annette Richards on her fine article "The Great American Litterbug." It is too bad that that article could not be published in every newspaper, both city and rural. While I have not had the privilege of visiting the National Parks, I can assure you that the same is true of our own State Parks, which I have visited. If the general public could be made aware of the damage done by such wantonly careless people, perhaps public sentiment could be aroused sufficiently to put a stop to it, and I must admit that we shutterbugs are just as guilty of being litterbugs as anyone else. Empty film boxes, burned-out flash bulbs, and so on are no better an addition to the scenery than waste paper and tin cans.

I have been a subscriber to your wonderful magazine since 1936, and have all the copies. I feel that it is a most worthwhile publication. . .

ERNEST B. RIECK

Albany, N. Y.

SIRS:

Annette Richards' "The Great American Litterbug" is extremely timely . . . The National Park Service should distribute at least an abstract of this fine article to every visitor in the Parks. Camp directors, A.A.A., and travel agencies should warn campers, tourists, and motorists against any kind of vandalism by pamphlets and by slogans printed on maps and the like as they did with some success against forest fires.

May I add that we all enjoy your magazine tremendously.

HANS M. SALZMANN, M. D.

New York, N. Y.

SIRS:

Your article on the Litterbug brought back to me three unpleasant recollections: (1) A man and his daughter putting their hands on stalagmites and stalactites in Carlsbad Caverns, just after the ranger had requested visitors not to do so for the good of future generations. It continued until I threatened to report the people to the ranger. (2) Seeing tourists *spitting* into Niagara Falls. (3) Finding a glaring, empty pretzel tin on beautiful Shannon Trail on Barro Colorado Island.

It is unfortunate that the article cannot be made "required reading" for every person touring the Americas.

W. E. LUNDY

Balboa Heights, C. Z.

SIRS:

It is impossible to believe the destruction of natural wonders that is caused by human beings. . . . It is difficult to say what we can do to prevent this, as I have seen persons who call themselves educated and well behaved do things of this sort.

I think your article should be publicized as much as possible, and perhaps in this way we can avoid the disappearance of some nice things.

J. M. TRISTAN

Rochester, N. Y.

SIRS:

. . . As a steady subscriber for the past fourteen years, I hardly think words could state what my husband and I think of NATURAL HISTORY. Today I read "The Great American Litterbug." I am a great lover of nature, but in order to enjoy it, we have to go far into the interior where the hand of man cannot reach. In the more accessible places, as your article states, nature is so abused that one gets little pleasure from it. At the end of the article you printed the slogan "This Is God's Country—Don't Make It Look Like Hell." Why couldn't this be sold on car stickers, where it would be a constant reminder to the American public on wheels. Each subscriber could sell so many. I would do my share . . . and the proceeds could go to further the work of the Museum itself—thus helping in two ways.

MRS. E. S. CHERRY

Portland, Ore.

SIRS:

I am a long-time subscriber to your NATURAL HISTORY Magazine and consider it one of the finest in the country. . . . "The Great American Litterbug" by Annette H. Richards is on a subject that should be brought to the attention of all our citizens, young and old. I have traveled this country in various directions and visited a number of parks and recreation areas. The litter and debris left behind by the average tourist is unsightly and disgraceful . . . Your article points up this subject in a very comprehensive manner, and the photographs furnish the visual evidence.

Perhaps you have already taken steps to spread this article far and wide . . . I believe that this subject, if brought to the attention of literally millions of readers, might have a salutory effect and start a trend in the other direction . . . If you hesitate to take this course owing to the expense involved, I would be happy to forward a small contribution, and I am sure others would do likewise.

FRANCIS W. DAVIS

Belmont, Mass.

SIRS:

. . . Your "Great American Litterbug" is a classic presentation of this problem.

JESSE NUSBAUM

Sante Fe, N. M.

The enthusiastic public response to the Litterbug article has enabled NATURAL HISTORY Magazine to continue the fight against vandalism. Approximately half a million stickers urging travelers to Keep America Beautiful have been issued and officials of our National Parks have kindly offered to distribute them at the gates of three of our most popular Parks. A limited number of them are available from The Editorial Office of NATURAL HISTORY Magazine.

Information and photographs have been made available to many newspapers, and a condensation of the article has recently appeared in the *Reader's Digest* for August.

The campaign will continue as far as funds permit.—ED.

Stinging Caterpillars

SIRS:

Some time ago I was stung, quite painfully, on the wrist by a caterpillar, so that I ached in the joints even to the shoulder for about eight hours. There was no real blister, but the damaged tissue did not heal for about three weeks.

We have one or more stinging caterpillars here, and I am curious to obtain more information on these creatures. Can you tell me anything about them?

STANLEY I. WALLAGE.

Corpus Christi, Tex.

Mr. Wallage appended a fairly complete description of the caterpillar that stung him, which enabled Dr. Frederick H. Rindge to identify it and offer the following information:

The caterpillars of a number of species of butterflies and moths possess nettle-like, or urticating, hairs. The stinging hairs may be present in the caterpillar, cocoon, and adult moth. It has been shown that they are hollow and contain a definite poison principle, which is injected into the circulation by the sharp-pointed hairs in contact with the skin, thus producing the rash.

Mr. Wallage's green caterpillar with lateral stripes of white and red lines was probably the larva of *Automeris io* (Fabricius), a widespread and common

Continued on page 332

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LXI—No. 7 SEPTEMBER, 1952

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THE COVER THIS MONTH

The sandpainting art of the Navaho Indian shepherds who inhabit the Southwestern deserts is unusual among folk arts since it is associated almost exclusively with the curing of illness. Here the medicine man adds the finishing touches to figures representing the Holy People, important Navaho deities, in order that his patient may be placed in closer communion with these powerful supernaturals. During most chants the patient sits on the painting, which is always destroyed and swept up at the conclusion of the ceremonial.

Sandpaintings are made of colored sands, charcoal, pollen, corn meal, and even flower petals. They range in size from a foot in diameter to some 20 feet or more, and large ones require the assistance of 15 men working all day. Although in this case the medicine man is aided by a woman, women rarely help to make sandpaintings unless they are learning the ceremonial. More than 500 different sandpaintings have been recorded, and probably many more exist.

Harry Tschopik, Jr.

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YOUR NEW BOOKS

Earth History • Botany • Albatross
Soil and Civilization • Arabia

FOURTEEN MEN

by Arthur Scholes

E. P. Dutton, $4.50
314 pp., 21 illus.

HEARD Island, in the Antarctic belt of the Indian Ocean, has always been one of the least known islands of the Far South. In the nineteenth century it was frequently visited by hunters of fur seals and sea elephants, many of whom hailed from Connecticut ports. These men were, however, sufficiently occupied in carrying out their bloody trade and in keeping alive in the face of the toughest possible conditions of weather and climate. They added next to nothing to scientific knowledge about their base.

Visits by properly equipped groups, such as the staff of the famous "Challenger," were all too brief for gaining more than scraps of information about the geography and natural history of Heard.

In 1948, the Australians finally instituted a thoroughgoing study by a party that remained in residence for more than a year. This book, by the radio operator, is the journal of the adventure and the serious accomplishments and is a very satisfactory "first report" on Heard.

Mr. Scholes' story is well told, and it contains an abundance of accurate and interesting natural history. Even the trivia will entertain most lay readers, particularly the incidents that reflect the important fact that 14 men could live both in isolation and in harmony and contrive to make an effective scientific team under environmental conditions that are as bad as anything to be imagined. The descriptions of the island, its surprising mountainous topography and quite unpredictable weather, are altogether enthralling. The accounts of the scanty vegetation and the life history of seals, penguins, petrels, skuas, sheathbills, and other Antarctic organisms are so excellent that the text will become a necessary source in the field of scientific writing.

End-paper maps show the relation of Heard Island to Australia, Africa, and the adjacent parts of the Antarctic Continent. Other illustrations comprise a satisfactory sketch chart of Heard Island, with its strange outline and its 9000-foot mountain peak, as well as a good series of photographs of the hardy Australians at work and of the native life of a highly inhospitable, even though fascinating, pin point on the globe.

R. C. MURPHY

A LAND

by Jacquetta Hawkes

Random House, $3.75
248 pp., 22 illus.

CAN you imagine a book on fossils, stones, industries, and such dry matters, written with poetic insight and fresh beauty of words and illustration? Here is such a book. Mrs. Hawkes has sought to portray her land as "an entity . . . in which past and present, nature, man and art appear all in one piece." Her success is brilliant! Her story starts with the formation of the planet Earth and ends today. Along the way, it traces the ebb and flow of ancient seas, the rise and fall of mountains, the coming of man, and his shaping by, as well as his shaping of, the old land through which his generations move.

Stegosaurus makes the author "think of some childlike scholar who has lost his wits, and having hung himself with tin trays and saucepan lids as a protection against his critics, strays through the rest of his life eating ice-cream and sipping crême de menthe." She likes the disputed remains of Piltdown man, a "Yorick who clowns, makes a mock of us, even with his bones." She mourns the outcome of the Industrial Revolution by which "the land, with which [man] must always continue to live, shows in its ravaged face that husbandry has been succeeded by exploitation."—The temptation to quote could easily lead on to quotation of the whole book.

This is neither science nor history. It is an aesthetic production, a work of art, drawing from science and history their more subtle significance. You may, indeed, learn here what trilobites were and when they lived, and learn correctly. It is more stirring to read (whether or not the scientist can abstain from an "if" or a "maybe") that trilobites exemplified "the first duty of consciousness" and that now it is "our minds alone [which] are free to go forward to something significantly new."

The land is Britain, but its history is that of Earth and its meaning is for everyone.

G. G. SIMPSON

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BOTANY

by Carl L. Wilson

Dryden Press, $6.10
483 pp., 420 illus.

THIS magnificently planned, written, printed, and illustrated work is a textbook on botany. The author describes it as an introduction to college botany and intimates that by paring it down it may be used in one-semester or two-quarter courses. It is so closely integrated, however, that omission of material would be a difficult matter.

The book follows the usual practice in such treatises: a little more than half is devoted to plant structure and function, the rest to a general survey of the world of plants and their classification. Each chapter ends with a summary.

High marks must be awarded to the planners of the modernistic format and layouts. Color (red) is employed extensively to delineate the chapter headings and to frame the excellent half-tones. Red is used also as a separating medium in tables. Red type names and pointer lines occur in the diagrams. The colored parts clarify and brighten the whole work. The hand-drawn illustrations, such as sections through wood or leaf, are beautifully done by Hannan T. Croasdale. Gardeners will be disappointed, because, as is usual in general botanies, the angiosperms are telescoped into 25 pages at the end of the book.

One small difficulty occurs: so many of the illustrations have been bled out to the edge of the page that many page numbers have been omitted and it is sometimes a little difficult to find a desired page after consulting the index. An extensive glossary and a good index are included.

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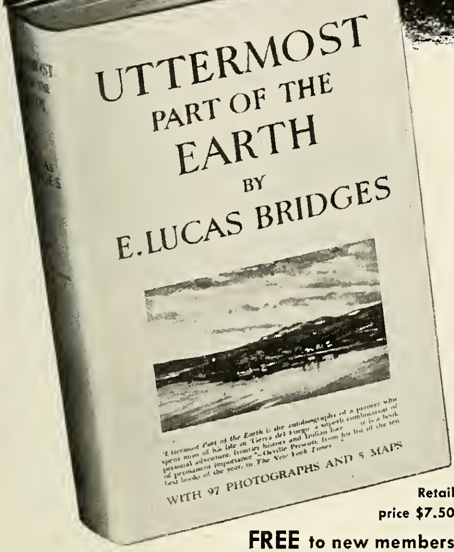

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Illustrated by FRANCIS LEE JAQUES

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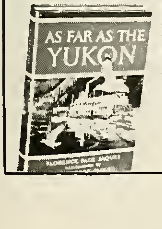

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and students, persons who are at all interested in the way plants "work" should have this book at hand.

G. H. H. TATE

TENTS AND TOWERS OF ARABIA

- - - - - - - - - - by Robert Shaffer

Dodd, Mead and Company, $4.00
276 pp., 11 illus.

ARABIA has for many years been portrayed to Americans mainly through British eyes with formidable coverage ranging from Doughty to Philby. In this instance we have Arabia presented through the discerning eyes of an American State Department official stationed in Jidda.

Highlights of this excellent book include a remarkable description of the modern pilgrimage to Mecca and the author's firsthand impressions of King Ibn Saud.

Throughout, the chapters are filled with amusing kitchen Arabic phrases denoting reality for the incidents and events related, many of which are common to travelers in the Arab world, although rarely so well described.

In his chapter entitled "The Land of Sheba," the author has journeyed southward through the eyes of another, to the Kingdom of Yemen. Unfortunately "a few of the little known but interesting facts" stated here require slight modification—Mareb Dam burst for the final time in the sixth century, not the fifth. The earliest recorded kingdom was undoubtedly not the Minaean but the Sabaean. Imam Yahya was certainly not murdered while riding a donkey on his way to a mosque. Five Miles outside of Sana on the road to Hodeida rests a large pile of stones marking the spot where the Imam's car was blocked while enroute to inspect some irrigated land. He was machine gunned with several others as he sat in his royal limousine holding his two-year-old grandson, who died in his arms. Abdullah Wazir lost his head within a month; however Prince Abdullah, who was never imprisoned, still resides in Sana, along with Qadi Rageb Bey, neither being permitted to travel far outside the city gates without the express permission of Imam Ahmed.

This book should be read by everyone interested in Arabia in general and Saudi Arabia in particular.

For others, this account of little-known events within one of the world's least understood kingdoms should prove of value in comprehending the broader problems which today face America throughout the Middle East.

WENDELL PHILLIPS

WANDERING ALBATROSS

- - - - - by L. Harrison Matthews

Magibbon and Kee with Reinhart and Evans, $3.00
131 pp., 15 illus.

DR. MATTHEWS' book is an account of the island of South Georgia, which lies at the edge of the Antarctic Ocean about a thousand nautical miles east of Cape Horn. South Georgia, discovered by the great Captain James Cook, was the first known Antarctic land. It has been frequently visited by scientific expeditions, both large and small, and early in the present century it became the first shore base of the vast modern whaling exploitation. Consequently South Georgia boasts a large literature in the form of popular articles, scientific monographs, and books.

Among all of these, Dr. Matthews' small volume is the outstanding symphony of environment and life on this far-away, icy, and blizzardy outpost, which also happens to be a breeding ground for enormous numbers of seals and for some of the most famous and fascinating of oceanic birds. It even has a native land bird, a little endemic pipit, which enjoys the distinction of occupying a more southerly nesting station than any other songbird in the world.

The author, unlike most of his predecessors, was not dependent upon "glimpses." His experience was measured not in days or weeks or months, but in years. As a member of the notable British "Discovery" Committee, he lived long at South Georgia and shared the toil, the dangers, the exultation, and the high living of Scandinavian whalers and sealers, who are the best clad, best housed, and best fed men in the history of the world's fishing industries.

Consequently the book, which is filled with a wealth of precise natural history information, plays its tune on many strings. If you want to learn how men live and work and ruminate and chatter and eat and drink and fight—and yet get along amazingly well together—far from home and family, and even from law in most senses of that word, this book is your story. Incidentally, you will pick up more intimate and exciting information about albatrosses and petrels than you could perhaps find by reading fifty other books instead of these 131 small pages.

R. C. MURPHY

SOIL AND CIVILIZATION

- - - - - - - - - by Edward Hyams

Thames and Hudson, London and New York, $4.50
312 pp., 9 illus.

THE last five or six years have seen an extraordinary number of books on man's relationship, in fact his dependence, on natural resources. We have been warned in no uncertain terms of the dangers to our future welfare in our continuing to waste nonreplaceable sources of food and energy. We have been threatened by the twin specters of overpopulation and dwindling food supplies. The spectacle of our rivers loaded with good topsoil, of fields sliced by deep erosion gullies, of skies darkened by fine particles of earth blown from desiccated farms has aroused some of our own people to the irreparable damage that thoughtless agricultural practice may incur. The phenomenon is unfortunately world wide and unfortunately still increasing.

Mr. Hyams is concerned with this same problem. He conceives as his basic premise that there is a natural soil community of which man is a part. If he abides by the rules of this community, in other words if he works with the grain of nature, he preserves and enriches the health of this community. If he doesn't, he becomes a parasite and a destroyer that ends by destroying himself.

From prehistory and history he draws the evidence of man's varying fortunes in dealing with the soil. His originality lies in the perspective he gives this problem. Although he is inclined to blame science for many of the ills he describes, this may be overlooked as a minor fashion of the time and should not obscure the major service he performs.

HARRY L. SHAPIRO

PALOMAR, THE WORLD'S LARGEST TELESCOPE

- - - - - - - - - - by Helen Wright

The MacMillan Co., $3.75
188 pp., 37 illus.

THIS is a little book with a big story. It tells of a man with great dreams and the world's largest telescope, which was the object of his dreams. The man is the late George Ellery Hale, and the telescope is the 200-inch reflector on Palomar Mountain, in California.

The first of its seven chapters outlines the development of telescopes from Galileo to Palomar. Succeeding chapters tell of Dr. Hale's negotiations for funds and of the tremendous difficulties connected with the fashioning of the mirror and building the enormous mounting to support it. Then the reader is introduced to the mysteries of the telescope's operation and the nature of the work it will perform in conjunction with the photographic plate and spectrograph. The final chapter, on the dedication in June of 1948, quotes from several who spoke at that time and emphasizes the importance of this project to astronomers and its contribution to the advancement of our civilization.

This book is clearly written. The technical matter is accurately presented, and the several photographs and line drawings well chosen. It answers many questions that occur to the general reader concerning the construction, purpose, and operation of this great telescope.

Its usefulness would be much enhanced, however, with the addition of an index, and captions to the illustrations would also increase its value.

Altogether, Miss Wright has done an excellent piece of work in telling the story of the Hale Telescope and the men whose vision, hard work, and faith brought it from the realm of dreams to reality.

ROBERT R. COLES

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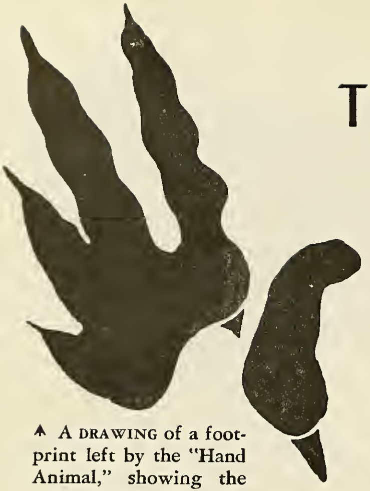


▲ A DRAWING of a footprint left by the "Hand Animal," showing the "thumb," which is now generally believed to be the little finger

The Case of the *Mysterious* "Hand Animal"

A huge animal that left footprints like human hands kindled one of the liveliest scientific arguments in the nineteenth century, and even today the mystery is only partly solved

By ANDREW HAMILTON

DR. FRANK PEABODY, now of the University of Kansas Museum of Natural History, was a quiet-spoken student at the University of California sixteen years ago when the "hand animal" tracks were discovered in northern Arizona. Later that discovery made him the world's top authority on one of the most fascinating mysteries that science has been called upon to explain—a century-old mystery that hasn't been completely solved yet.

It happened one cool December day in 1935. Major L. F. Brady of the Museum of Northern Arizona was warming his hands and admiring a new fireplace built by his friend Hubert Richardson, owner of the Cameron trading post and hotel on the Little Colorado River.

Suddenly the museum man's eyes bugged out in astonishment at what he saw in the flickering light.

"Where did this sandstone come from?" he asked excitedly.

Richardson slowly removed a pipe from his mouth.

"From those red beds up the canyon a piece. Why?"

"Man," said Brady, peering so intently at the rock that he almost frizzled his eyebrows in the fire, "look at those fossil footprints on that sandstone. You've discovered a mess of 'hand animal' tracks!"

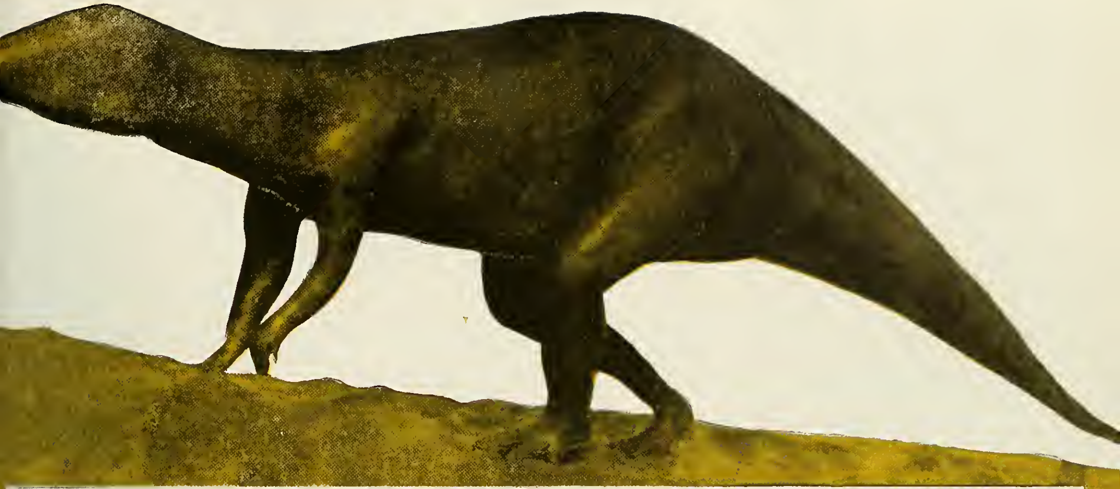
So he had. The mysterious tracks that resemble the imprint of a human hand had previously been unearthed in Europe but never before in North America. Since then, paleontological expeditions have been pecking at, prying apart, and preserving for posterity huge footprint-covered slabs of the red Moencopi sandstone that crops out in northern Arizona and southern Utah. They've also been trying to solve an old puzzle.

What were the mysterious "hand animals" that roamed the mud flats of at least two continents nearly 200,000,000 years ago? Why have the grotesque hand-shaped footprints of these beasts been found in the United States and Europe—but no skeletons or even bone fragments ever located? Were these enigmatic creatures that roamed the Triassic river valleys the forerunners of the dinosaurs, the birds, or man?

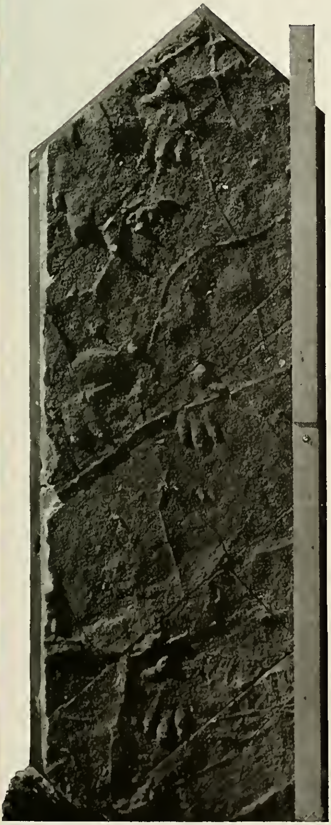
The first "hand animal" tracks known to science were found 128 years ago in England, but their significance was not at first appreciated. In 1834, a German by the name of Barth, when building a garden house in Hildburghausen, noticed odd handlike imprints on some of the sandstone slabs. The sandstone, deep red in color, had been quarried at a place called Hessburg and had been used to build the castle at Heidelberg and the cathedral at Strasbourg. Barth showed the curious rock markings to a friend, Bernhardi, who wrote a short scientific paper about them. The following year the ancient creature that made the tracks was formally named *Chirotherium* by Kaup.

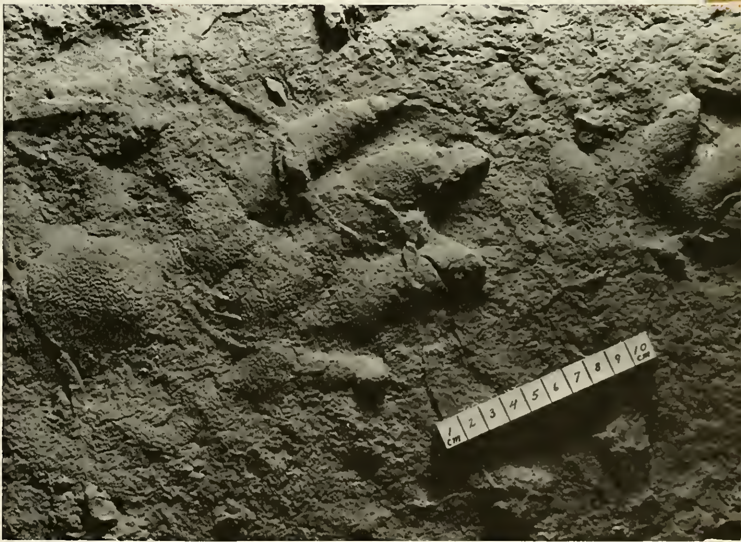
Since that time a number of similar fossilized impressions have appeared in stone quarries and excavations in England, Italy, Spain, and France. Only a couple of years ago a set of footprints was found near Bolzano in the Italian Alps.

Some of the fossilized tracks were as small as chicken tracks; others were as large as the jumbo footprints of elephants. But no matter what size, the hind footprints of the beast invariably resembled the human hand with its four fingers and thumb.



▲ A RECONSTRUCTION of the animal that made the *Chirotherium* footprints, as conceived by the late German scientist Wolfgang Soergel in 1925. Dr. Peabody believes that the "Hand Animals" were slightly stronger in the forequarters than this drawing would indicate

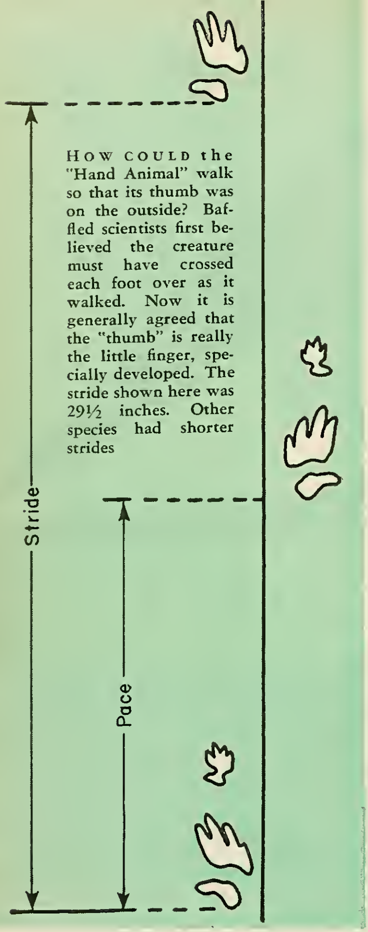




Photos by Frank E. Peobody

◀ THE REMARKABLE resemblance of the tracks to the human hand can be seen in the central print in this slab of stone, which can be viewed in the Museum of Northern Arizona. The mistaken identity of the "thumb" on the outside of the tracks earlier led some to believe that the animal crossed its feet in walking. At the left are parts of two much larger tracks

▲ CLOSE-UP of a large hind footprint and a small front one of the dinosaur-like *Chirotherium* that roamed Arizona nearly 200,000,000 years ago. The hind foot shows remarkable similarity to the human hand except that the "thumb" is really on the outside, a fifth toe. The feet were covered with typically reptilian scales, as shown by this remarkably clear impression



HOW COULD the "Hand Animal" walk so that its thumb was on the outside? Baffled scientists first believed the creature must have crossed each foot over as it walked. Now it is generally agreed that the "thumb" is really the little finger, specially developed. The stride shown here was 29½ inches. Other species had shorter strides

Since their discovery in a German quarry more than a century ago, the curious tracks have been the subject of some fiery arguments. And the debate is not over yet. Some paleontologists argued that the "hand animals" must have looked like giant bears, apes, or baboons. Others insisted on an opossum or kangaroo-like creature. A third group of scientists held out for a dinosaur-shaped beast or amphibian. What stumped most of the learned men, however, was that *Chirotherium* footprints featured a "thumb" on the *outside*—just the reverse of the human hand.

Charles Lyell, the British geologist, once pictured the creature as a large froglike amphibian that shuffled along "cross-legged." In other words, to get the "thumb" on the outside, it had to cross each leg over every time it took a step.

For many years scientists could not agree whether or not this oddly-placed digit was really a "thumb." It is pretty well established now, though, that it wasn't a thumb at all but a kind of overgrown little toe—used primarily for support and balance.

Peabody got into the act in 1938. In that year the University of California sent an expedition to Arizona to explore the cliffs that had provided sandstone slabs for Richardson's fireplace. Peabody went along as a graduate student, and he has wrestled with the mystery of the "hand animals" ever since. In 1948, he published a six-year study of the creature—the most comprehensive scientific treatise on the subject ever written.

Scientists who had previously investigated the *Chirotherium* were exasperatingly handicapped because, in spite of all the tracks that had been laid bare, no bones had ever been found. They were somewhat like Sherlock Holmes in possession of a few fingerprints but no corpus delicti.

Dr. Peabody soon realized that he'd have to tackle the paleontological mystery from another angle. He did, and as a result he perfected a shrewd technique of scientific detection.

Well known is the fact that paleontologists can sometimes identify a prehistoric animal from a single vertebra. Dr. Peabody wondered: "Maybe tracks alone—

Photos by Frank E. Peabody

▲ STUDENTS examining fossil-bearing rock from the Age of Dinosaurs

◄ DR. FRANK PEABODY turning over a slab of thin-layered shale. Most of the tracks of the "Hand Animal" are found on the underside of rocks. They were formed when sand settled in the footprints in the mud and became sandstone

properly studied and evaluated—can yield important clues about the animals that made them."

He knew that 200,000,000 years ago northern Arizona's present 5000-foot plateau country, just south of the Grand Canyon, was a great delta land near sea level. The Sierra Nevada and the Rockies had not yet been thrust up, and a long salty arm of the Pacific covered parts of California, Nevada, Utah, Idaho, Wyoming, and Arizona. Along the shores of this sea and the sluggish rivers that fed it, *Chirotherium* padded along, leaving its curious footprints in the soft mud and ooze. The sun dried the mud, and later wind-blown and water-carried sand settled in the depressions. Each season laid down another layer of mud and sand, and footprints were preserved as neatly as if an FBI man had made casts of them.

The more he puzzled over these strange footprints, the more certain Dr. Peabody became that single tracks couldn't offer as many clues as a series of three or more "trackways," as he called them. So he set about to evaluate the length of pace and stride, the relative deviation of the feet from the mid-line, the angulation of the prints, and the characteristics of the tracks themselves. All these factors, he was convinced, would serve as a yardstick with which to reach valuable scientific conclusions.

He started his detective work by studying the paw marks of wild animals in northern California. As a graduate student at Berkeley, he tramped through the mud flats of south San Francisco Bay, the sandy banks of the Russian River, the shores of lakes in the High Sierra. His sketchbook, camera, and sack of plaster of Paris recorded hundreds of examples.

After observing the tracks of reptiles, birds, and mammals in their native haunts, he returned to the Berkeley paleontology museum. There he created artificial mud flats and prepared specially-smoked pieces of paper for lizards and salamanders to run across. After additional months of solid, laborious research, he found that he could identify most living salamanders on the basis of their footprints alone.

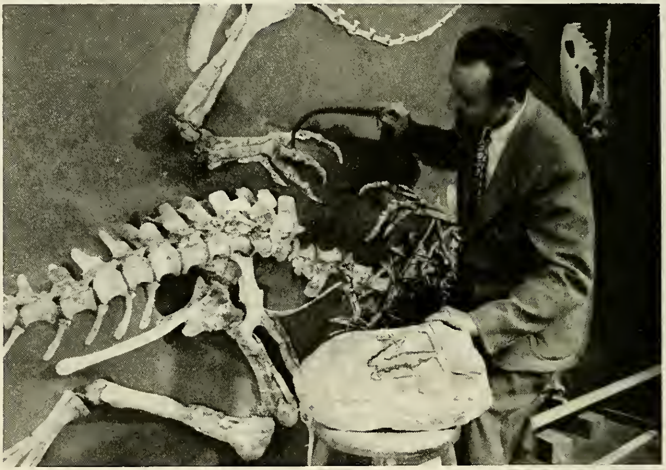
The next step was to familiarize

Photos by Frank E. Peabody

▲ Dr. Edwin C. Galbraith and Dr. Frank E. Peabody turning over slabs more than 230 million years old, looking for fossil footprints of animals older than *Chirotherium*

▲ A cliff face near Cameron, Arizona, showing a cross section of a Triassic river bed made up of thick layers of sandstone separated by thin layers of shale. The sandstone layer directly behind the Greyhound radiator cap of the automobile contains numerous "Hand Animal" prints on its lower side

➤ Dr. Frank E. Peabody comparing the toe of a large three-toed, carnivorous dinosaur with the fossil footprint of a smaller individual of the same species. Thus it is possible sometimes to match a footprint with a known skeleton from the same geologic horizon. But this has never been done yet with the "Hand Animal"



A.S.C.U. photograph, Univ. of Calif. at Berkeley

himself with the trackways of animals no longer living. He studied fossilized salamander footprints made during Pliocene times (4 to 5 million years ago) and those of Paleocene times (75 million years ago). He found that his trackways technique would work as well for the prehistoric past as for the present.

Footprints can talk—if you know the language, he decided.

Dr. Peabody was then ready to examine the "hand animal" tracks made during the Triassic period—the so-called Age of Reptiles, which began 200,000,000 years ago.

From 1938 to 1949, he made five expeditions to northern Arizona and southern Utah with University of California parties under the leadership of Dr. Charles L. Camp and Dr. Samuel P. Welles, to dig into the red sandstone formations of the Moencopi. They found plenty of tracks in the region of the Little Colorado River of Arizona and Zion Canyon of Utah. Some of the richest deposits lay almost within the shadow of the famous Meteor Crater.

Collecting trackways belongs to the arnica-and-liniment division of the scientific professions. It requires not only a pick and shovel but plenty of muscle—and occasionally a crane and a two-ton truck. Dr. Peabody says, "It's like ripping up a 50-foot stretch of city sidewalk and carting it to a museum 800 miles away, all the time taking care not to scuff the hopscotch pattern chalked on its surface."

Trackways are usually found on the underside of sandstone layers. Most people grasp the fact that the footprints were first made in the mud and then covered with sand, both layers solidifying later. Thus it is necessary to turn the sandstone slabs over to see the tracks, in raised relief.

One old prospector who wandered into camp near the Meteor Crater scratched his whiskers at this explanation and wrinkled his sunburned brow:

"Yeah, but I still don't rightly understand how thet critter stomped on the underside of them rocks!"

Once the slabs are pried or hammered loose, they are paired off like slices of bread, and a filling of sawdust shavings is put between. Roped tightly together, they are freighted by rail as "rock specimens."

Thousands of square miles still are available for future paleontologists who may wish to explore the mystery of the "hand animal." The underside of almost any northern Arizona sandstone ledge may have the cast impression of an old stream channel or mud flat. In fact, the Moencopi is a great treasurehouse of fossil remains, not only of the *Chirotherium* but a number of other reptiles and amphibians that lived during prehistoric times.

While the Moencopi formations of Arizona have yielded many "hand animal" tracks but no fossilized bones, the reverse is true of amphibious creatures. Very few tracks of salamander-like beasts have been located, but the red sandstone abounds in amphibian skeletons. This is probably due to the fact that the amphibians lived in the water and marshy areas, while the *Chirotherium* merely used the riverbanks as a highway to get from one place to another.

Some of the richest deposits in the Moencopi formations are to be found in exposed hillside outcroppings. Whenever engineers build a new highway or railroad in the area, their excavations are apt to reveal new tracks. Dr. Peabody says that Dr. Welles once spotted a set of well-preserved *Chirotherium* tracks in rocks that workmen had dug up to make way for a telephone pole.

In excavating for the bones of animals long since extinct, the *Chirotherium* hunters were often the object of great curiosity on the part of wildlife in that part of the Southwest. Porcupines would snuffle around the ledges not far from where the hammering and clanking was going on, furtive-eyed coyotes lurked at some distance, and fleet pronghorn antelope raced down the canyons at top speed.

Dr. Peabody's most friendly visitor, however, was a foot-long collared lizard whose ancestral tree might be traced back to the animals whose fossilized footprints were being removed from the Arizona hillside. This handsome reptile, garbed in the latest desert shades of brilliant turquoise, lemon yellow, and scarlet, became so fearless it would climb up on one's shoulder and snap at dead flies held in the hand.

The paleontologist swears the friendly lizard would cock its head first one way and then another as if to say, "What's new in my genealogy?"

The only animal that gave the digging parties any trouble was a red-eyed Hereford bull. One day Dr. Peabody was walking blissfully along, examining the ground for fossils. He didn't see the bull, but it spotted him and was in the dust-pawing stage. The pondering paleontologist barely had time to sprint for a near-by rock and dive like a ballplayer coming into second base.

The University of California expeditions didn't worry nearly so much about angry bulls, however, as they did about "dust devils," those small twisters that march across the hot desert. One of these swirling whirlwinds hit the Meteor Crater camp one day and, with a roar, "exploded" and scattered tents, cooking utensils, bedding, papers, food, and clothes over the surrounding landscape to the distance of half a mile.

But in spite of such occasional hazards, many a sandstone slab was uncovered, crated, and shipped to Berkeley.

Over a ten-year period, the University of California's five expeditions tracked down a total of eight distinct species of "hand animals" —two of them known from previous European excavations, six brand-new ones.

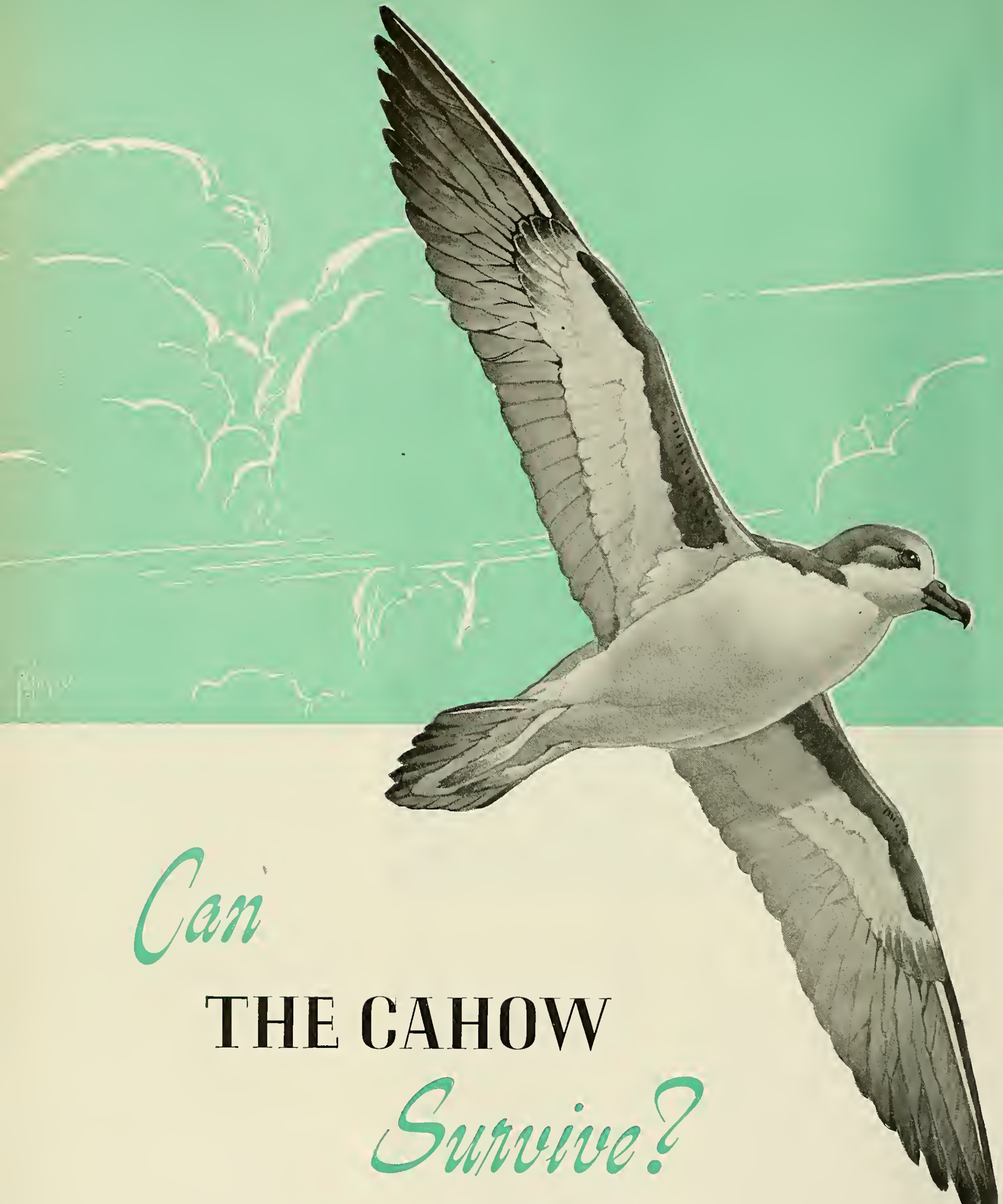
The largest single collection of "hand animal" tracks in existence today, thanks to Dr. Peabody and his colleagues, can be seen in the Museum of Vertebrate Paleontology at the University of California at Berkeley. It is said to be as good or better than any European collection. Smaller collections can be seen at the Museum of Northern Arizona in Flagstaff and at the Bright Angel Museum in Grand Canyon National Park. And the curious tourist can still warm his hands before the footprint-studded fireplace at the Cameron Hotel.

Dr. Peabody is now willing to assert with reasonable scientific assurance that the "hand animals" were reptiles. Presumably, they possessed reptilian heads and long tails, and they walked on four scaly feet. In many ways, they may have resembled two-legged dinosaurs, but they weren't true dinosaurs. They ranged in size from creatures about as large as a cat to those of elephant proportions. The biggest of all certainly must have been king of the Triassic landscape.

Most *Chirotherium* tracks show that the front feet were smaller and carried much less weight than the hind feet; their method of locomotion differed markedly from the crawling, sprawling movement of such creatures as frogs, salamanders, and reptiles. Even though the "hand animals" were among the first vertebrates to start bringing their front legs under the body —a development that man has carried to the extreme—they never quite succeeded in walking on hind legs alone.

Although Dr. Peabody has pretty well described the appearance of the "hand animals," some minor mysteries remain. For one thing, what role did this prehistoric creature play in the march of evo-

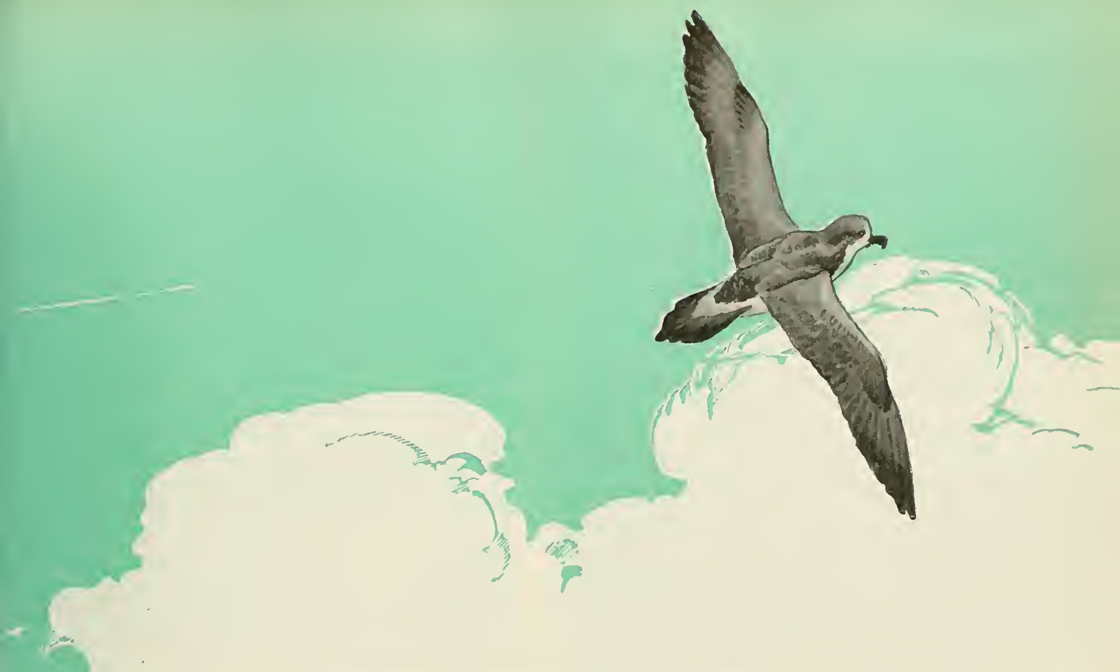
Continued on page 336



Can THE CAHOW Survive?

By PAUL SHEPARD, JR.

Drawing by Francis Lee Jaques



Bermuda's rediscovered bird of mystery is represented by only one known pair, and its single offspring disappeared. It survived unknown for three centuries but now faces a greater test

THE secret existence of this rare petrel was unknown until January, 1951, when it was "discovered" by Dr. and Mrs. Robert Cushman Murphy of the American Museum of Natural History and Louis S. Mowbray, Director of the Bermuda Museum. On a tiny island off western Bermuda, a few pairs were found, and the bird was photographed for the first time. The world at once wondered whether the cahow could be saved from extinction.

Since the days of Captain John Smith and the Virginia colony, small numbers of cahows had been coming in from the sea in silence and darkness to their nests on offshore islets. The bird had previously flourished in great numbers, but it was thought to have been exterminated by 1620.

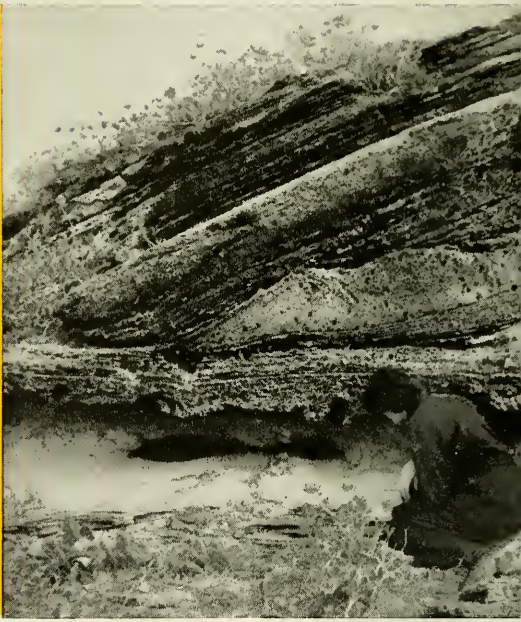
Because incubation had already begun when the re-discoverers found its haunts last year, little was seen of the elaborate courtship performance that might be expected of a petrel. The birds had quit calling and were extremely difficult to count. What sort of rituals they performed and how many birds actually survived, living out at sea and returning only at night, were unanswered questions. Even the cahow's name had suffered ambiguity, because it was based on the call, and in 330 years no one had heard it. Some persons wondered whether the cahow might not have lost its ability to give the loud cries described by early settlers as a "clamor" or an "uproar."

Our team to follow up the bird's discovery was appointed by Dr. Murphy and sponsored by Mr. Childs Frick and the Bermuda Government. We visited the islets during the critical period when breeding was initiated. Working in staggered periods, Robert Perkins and the author investigated many burrows during five weeks in December and January. My wife Melba, David Wingate (a young Bermudian ornithologist), and his companions the Zuill brothers also spent nights watching for cahows. Louis Mowbray, who had help to rediscover the birds, was a partner too.

We saw them first a few minutes after the last trace of light vanished westward toward America and the Christmas lights of Hamilton, nine miles away, tinged the opposite horizon. In from the open Atlantic, their trim silhouettes streaking low over the islet—as though out of oblivion and into history—the cahows were arriving to court and establish breeding grounds.

Against the stormy night skies of

▲ **UNTIL RECENT YEARS,** several of the islands off the west coast of Bermuda have harbored cahows, and these tiny spots hold the bird's future



▲ **MELBA SHEPARD** checks possible cahow burrows but without finding evidence of occupation. Wave action is undermining the islet in places

winter, these swift petrels are difficult to see. But we were determined to observe their behavior before egg laying. During courtship, the birds flew erratically over the island in pairs, emitting cooing sounds and loud, scratchy "eet" noises. These calls were in strange harmony with the crashing of the waves against the base of the tiny islet and the continuous whine of the strong, stormy-season winds.

When alone, the cahow flies very swiftly, and careful watch is required to see it against the faint light reflected from the clouds. Often when the bird was approaching the islet at low level it would dart suddenly straight up into the sky. This flying up was seen many times and was always a spectacular and delightful sight.

The few cahows that have survived burrow seven or more feet into sandy pockets between layers of limestone. The only island now occupied for certain is less than one-half acre in extent, and only *one pair* of cahows is known to live there. The only young bird hatched last spring disappeared when half grown. Others may have nested in high cliffs along the main coast or in other undiscovered burrows where no one has watched the night out, but this fragile, black-and-white oceanic bird is probably reduced to numbers comparable to those of the Whooping Crane at its lowest.

What, then, are the chances of their increasing sufficiently to withstand the forces threatening them? Such answer as can be given lies in our knowledge of the history of the bird and its habits and requirements.

Much of the originally rich bird life of Bermuda was exterminated by the early colonists and their livestock. All except one of the Bermudian species of birds, however, were known from other parts of the Atlantic or the Continent. This was our cahow, a ground-nesting "sea fowle," edible and defenseless.

It seems miraculous that it had not actually vanished. A reconstruction of its history since 1620, based on various scraps of evidence, indicates that it has become adapted to an existence in very small groups. This is a remarkable change for a bird whose breeding pattern supposedly depended upon the simultaneous performances of hundreds of noisy individuals. From observations on other birds, we know what a threat to survival a drastic reduction in numbers can be, because of the inhibiting effect it has on courtship behavior. Also, some members of the same family, when expanding their range into new territory, skip several breeding seasons until additional arrivals have increased the population to threshold size. But there is no source of new members of the cahow population from distant breeding grounds.

Accompanying the early Bermudian colonists was the Black Rat, which is smaller and less voracious than the Norway or Brown Rat. In spite of possible foraging by the

Black Rat, which swims and climbs easily, and the raids by the settlers, the cahow survived on a few tiny islets off the Bermuda coast. Our search disclosed two islets with groups of cahow burrows but with no cahows. What had happened to the birds that had managed to breed there until very recently? The answer depends on further study of Bermuda rats. The Norway Rat had arrived late in the nineteenth century. Did it spread rapidly, crowding out the Black Rat, as it does in temperate climates, or was it contained in small, isolated pockets as it often is in the tropics where the Black Rat is more successful?

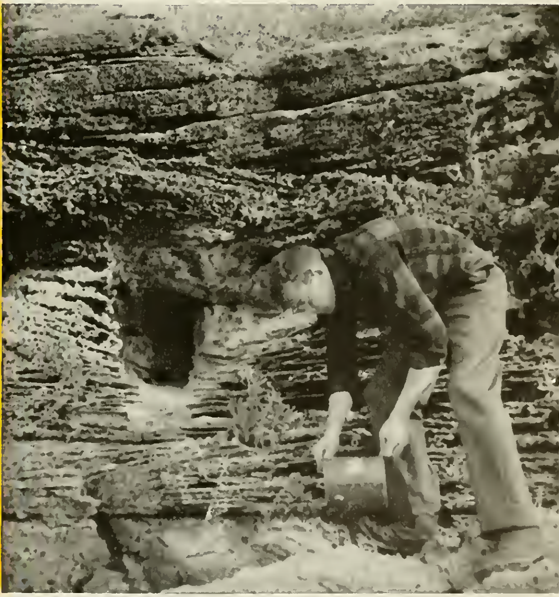
These questions lead directly to the major one concerning the cahow's future. In 1942, the U. S. Air Force, leasing a large section of Bermuda, changed the shorelines by dredging. The connection of large Cooper's Island to the "mainland" provided a land bridge into the midst of the islets where the cahow nested. The military establishment probably encouraged rats as well, and perhaps inadvertently started the Norway Rat on a rampage by providing a springboard and the city-like conditions upon which it thrives.

Large areas of the soft basal rock which forms the islet where the cahow is nesting have been eaten away by water action, gradually undermining the little island. An observer, reclining to watch for cahows in the black sky, is continually aware of the trembling ground as the surf chews away the limestone in muffled thumps deep beneath him. In terms of hundreds of years, the islets seem to be falling apart, and it is not difficult to visualize a time when they will be uninhabitable for cahows because of the encroaching sea. In short, the future of the cahow is by no means assured. But measures can and must be taken to remove certain obvious threats. Continuous extermination of rats on the breeding grounds, protection from all human interference, and sympathetic help and understanding from all Bermudians who can see or be shown the satisfaction of preserving a form of life that is unknown elsewhere—all this may help the cahow.

Yes, we heard the cahow cry its own name, but not until the very end of our stay. David Wingate was the first to hear it, and the others heard it on different occasions—always out at sea, in the darkness. The lonely, thrice-repeated call is killdeer-like, but it seems to be voiced rather than whistled. It has a little of the harsh, carrying quality of the typical sea bird's voice, which is difficult to render phonetically. It is somewhere between *Ka-how'* and *Ka-hoo'*, and can be poorly represented at best by *Ka-heu'*, *Ka-heu'*, *Ka-heu'*.

In the emptiness of the dark ocean it seemed pathetically appropriate, faintly echoing the great cahow chorus that has not been heard for centuries.

▾ ROWS OF SODA STRAWS across the entrances of the burrows told whether a bird had entered between periodic checks by flashlight



▾ THE AUTHOR placing poisoned grain to destroy rats that now infest the tunnels once ruled by the cahow. Generations of birds had worn this tunnel smooth

Discovery of a GIANT TOAD

A strange tale led to an exciting search and to the finding of what may well prove to be the Gargantua among South American toads

By Rolf Blomberg

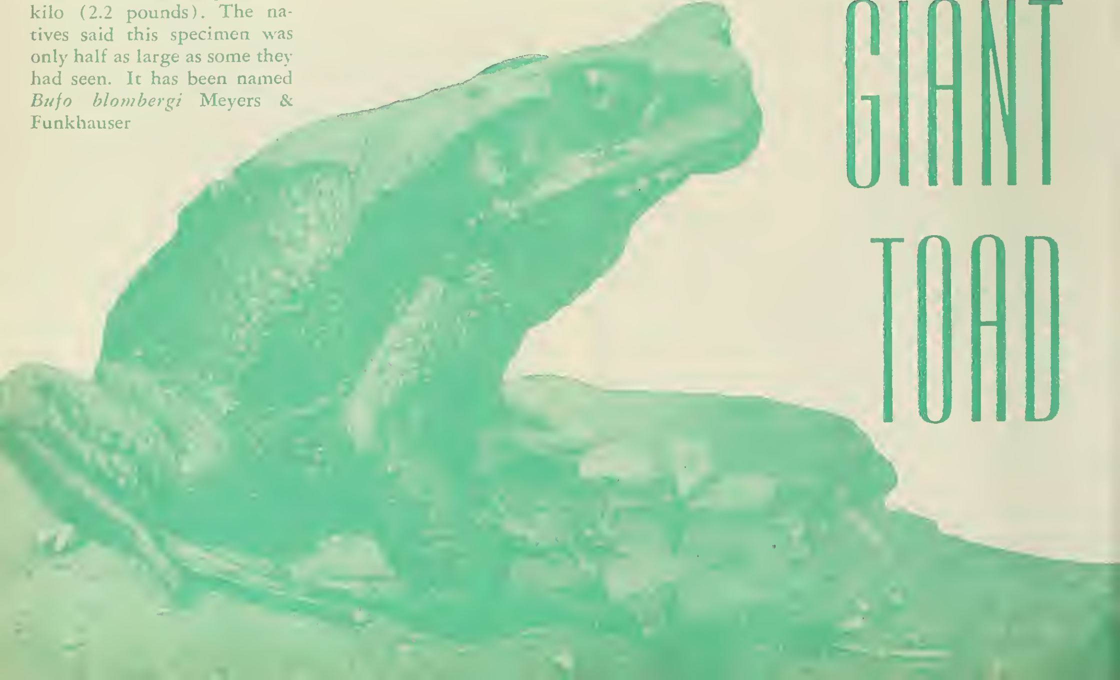
All photos by the author

FOR some reason, a frog hunter is not resplendent with the same glory as, for example, a jaguar hunter. Indeed, there were some people who laughed heartily when I announced that I was setting off to Colombia on a frog hunt. I wanted to find out whether there was any truth in some sensational rumors—sensational from a naturalist's point of view, anyhow—that a frog or toad of gigantic size was still hopping around undiscovered in the southwestern part of that country.

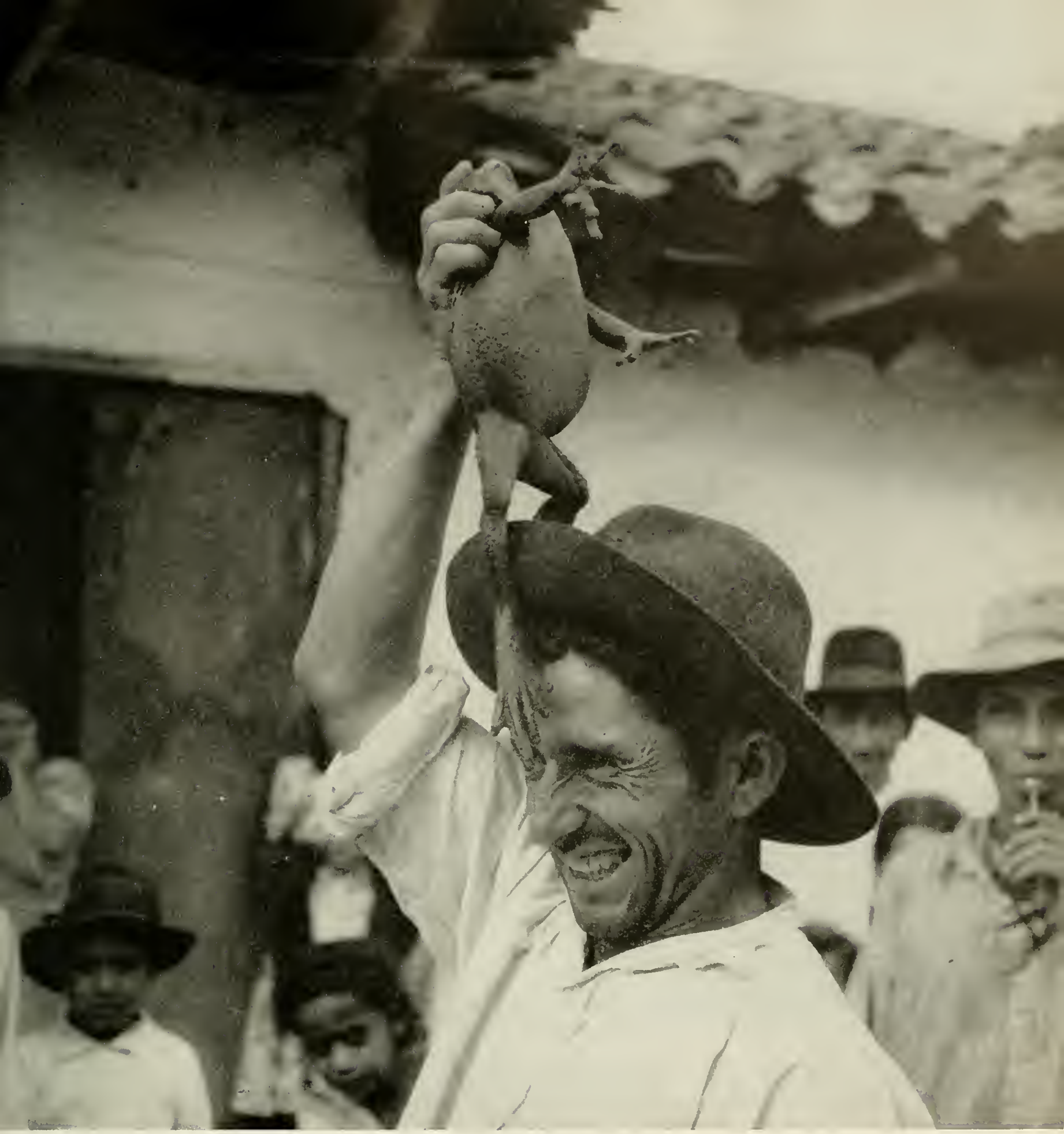
The first person who told me about the giant frog was a Colombian whom I met in the Galápagos Islands. We were making long trips together into the interior of Indefatigable Island, collecting zoological material and taking moving pictures. The Colombian was an excellent companion and also proved to be a keen observer, supplying me with much interesting information on the unusual fauna of the islands. My surprise was therefore great when he told me about the giant frog, which he claimed to have seen in the province of Nariño in southwestern Colombia, saying that he estimated its weight at two quintales—that is, two hundred pounds!

In a tactful way I tried to make him bring the figure down some 190 pounds, but he was inflexible. His statement was, of course, unbelievable. Such a monster could not possibly exist. But I decided to investigate, for I had a notion that there must be *something* behind the story, since my informant was otherwise such a truthful person. Where there is smoke there is apt to be fire, and some of the most interesting things in nature have eluded science.

Were not all the rumors about the world's largest lizard, the dragon-like *Varanus komodoensis* of the Lesser Sunda Islands, dismissed for many years as mere fantasy? It was not until 1912 that naturalists finally got irrefutable proof of this animal's existence. And the world's largest frog, the African *Rana goliath*, had to wait almost as long to be discovered. This enormous amphibian, which according to description is as large as a medium-sized terrier, lives in the deep, slug-



➤ PREVIOUSLY UNKNOWN to science, the toad weighed one kilo (2.2 pounds). The natives said this specimen was only half as large as some they had seen. It has been named *Bufo blombergi* Meyers & Funkhauser



▲ WHEN offered ten pesos per specimen, the villagers said, "The cost of living is so high nowadays that people are even paying for frogs!" But this native of Nachao brought in a toad worth looking at

gish rivers in southern Cameroun and in the Gabon district in French West Africa. It is only caught by natives fishing when the level of the water is specially low after a long period of drought. The Negroes eat the large frog with gusto, and its "thighbones" are highly coveted for use in magical rites. As a result, only a few complete specimens have reached museums.

That South America's immense and still partly unexplored jungle regions, which extend from Colombia in the north to Argentina in the south, might still conceal a frog as large as *Rana goliath* was, of course, not impossible. As a matter of fact, no other part of the world presents such a variety of batrachians as tropical America.

▲ **THE AUTHOR** was lured to southwestern Colombia by stories of a mammoth frog that might rival Africa's *Rana goliath.* Eight giant frogs like this one in the town of Pasto seemed to strengthen the possibility

Further investigations partly confirmed my first information. In Quito, Ecuador, I met two Colombians who had traveled in the region where the mammoth frog was supposed to live. Both testified that a frog or toad of huge size was to be found here, much bigger than the large forest frog *Leptodactylus* or the great horned toad *Ceratophrys,*[*] which attain a weight of one pound each.

So chance was beckoning, and although I was still feeling a certain skepticism, I decided it was worth while to find out whether the giant amphibian existed or not. My friend John W. Funkhouser, of the Stanford Museum of Natural History, who had come to Ecuador for a few months to study the batrachians of the equator, gave me some encouragement. He considered the existence of a still undiscovered South American giant toad or frog quite possible.

The small town of Pasto at the foot of the Galeras volcano in south-

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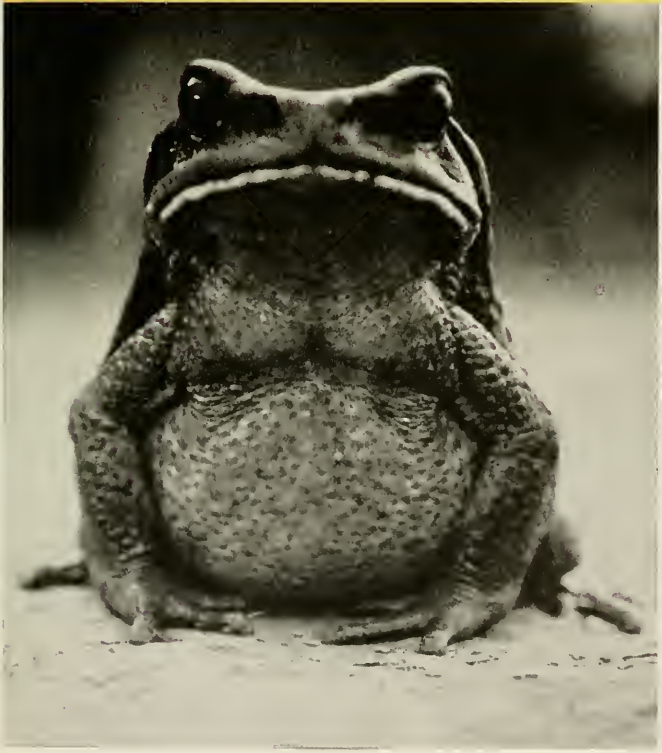
[*] This is, indeed, the real horned toad, not to be confused with the North American lizards of the genus *Phrynosoma,* popularly called horned toads.

▲ **A NARROW AND DANGEROUS** mule trail led down the western slopes of the Andes to Policarpa

▼ **GLANDS** on both sides of the toad's neck exuded a creamy fluid, which proved to be poisonous



ern Colombia was the starting point for my collecting trips both to the east and west. The fact that a couple of fountains on one of Pasto's squares were embellished with eight giant frogs seemed a good omen. Naturally, I hoped that these sculptures had been inspired by real animals. In darker moments, I realized that they could just as well have been the *cause* of the rumors!

According to my Colombian friend in the Galápagos, the monsters had their haunt in a small lake near a village with the odd name of El Castigo—"The Punishment." To locate the village required some detective work; I could not find it on any map. No wonder. It proved to be only a couple of tiny mud houses, though I was told that its population had been considerably larger some years before. At last I was able to mark El Castigo on my map and start down the western slopes of the Andes.

First I went a considerable distance by bus. Then I walked an entire day over an unpleasantly narrow and dangerous mule trail which wound down toward the coast, bordering dizzy abysses. This is definitely no trip to be undertaken by anyone inclined to giddiness. I had joined a mule caravan that was going my way, and although mules are famous for their ability to pick their way like goats over the worst kind of country, the animals more than once came near losing their footing here. One of the mule drivers told me that he had already lost six animals on this trail; and as evidence of the danger, we saw deep down at the bottom of an abyss the carcass of a horse or mule completely covered with feasting black vultures.

In the village of Policarpa, where it was easier to get accommodations than in the neighboring El Castigo, I set up my headquarters. I had not been there many hours before the news of a "crazy gringo hunting for frogs" had spread like wildfire in the village. My presence caused great wonder and no less merriment.

When I promised to pay the

➤ THREE of the author's assistants, amid the gigantic foliage of the tropical forest

whole of ten pesos for each faultless specimen weighing more than four pounds, one of the villagers said, "The cost of living is so high nowadays that people are even paying for frogs!"

The information I gathered from the villagers about the giant frog varied widely. Some could swear they had seen frogs weighing at least one arroba — twenty-five pounds; others declared that the largest specimen only attained a weight of four to five pounds. However, all agreed that the latter certainly existed.

But I was told that I had selected the worst time of the year for my frog hunt. The season was now at its driest; no rain had fallen for months. It used to be very different, they told me, when the jungle grew thick around Policarpa and El Castigo. The climate had become drier as a result of unscrupulous burning, which had devastated the jungle growth. The little lake at El Castigo—the one where my informant had seen the giant frogs—was completely dry. Only during the rainy season could it be called a lake. I was advised to come back in the rainy season. "Then," they said, "the frogs will croak and make so much noise at night that you will have to yell to make yourself heard!"

I had come a long way for the sake of finding a giant frog and was not happy at the thought of returning without a good try. In the ravines, particularly around the creeks, which were overgrown with thick jungle vegetation and difficult to get to, there ought to be frogs and toads even during the dry season. So for several nights I made my way to these locations, and so did some of the villagers. With the aid of flashlights, we found a number of batrachians but no giants.

One morning, however, a man came from the village of Nachao, which lies a good bit lower than Policarpa, with a sack over his shoulder. "You are the gentleman who buys frogs, aren't you?" he greeted me and turned his sack inside out. With a thud, a large, ugly toad fell to the ground.

"Sure, this is a *sapo saíno*, the kind we are looking for," said the villagers. All the people, including the one who had caught it, agreed that this was a small specimen; ones at least twice this size and even larger existed.

My toad weighed one kilo (2.2 pounds). That it belonged to the *Bufonidae*, the toad family, was evident; but judging from its shape and colors, it was not a *Bufo marinus*, the largest South American toad known to science.

Most of the villagers showed a superstitious fear of the toad. Some declared that one could get bad eczema and boils from touching the creature, others that it was snappish, still others that just the sight of it brought bad luck! They told me about "another crazy gringo" who had eaten a *sapo saíno*, "probably believing it to be a turtle." He had swollen up like a balloon and had been deathly ill for many days.

The statement that the toad could cause eczema might not have been superstition. A creamy fluid secreted from glands on both sides of the neck looked repugnant and dangerous, and later examination proved it to be poisonous.

In the same region there also existed some small, rather dangerous frogs, the beautifully orange-colored *Phyllobates* and *Dendrobates*, which have a very poisonous secretion on the skin. The Choco Indians in northwestern Colombia are said to stew these frogs to obtain a deadly poison for their arrows. I secured one of these nasty little creatures to include in my collection from southwestern Colombia.

The rich reward I gave the catcher of the one-kilo toad was a spur to greater effort, and the whole village went toad hunting the following nights. But all in vain.

"It's much too dry now," they said. But they promised that if I came back when the rains had set in, they would catch more *sapos* than I could transport back to Pasto.

My disappointment was great as I traveled back to Quito with my goggle-eyed toad. I had really hoped to find a batrachian of considerably larger size. But when I met Dr. Funkhouser and showed him my prize, he was very excited.

"What more do you want?" he said. "You have probably discovered the largest toad in the Americas."

Soon after, Dr. Funkhouser returned to California, and he took along my toad in order to examine it carefully in comparison with others. After a couple of months, he wrote me; and I must say I was thrilled to read what he had to say: "Dr. Myers and I have now worked on your toad, and I am glad to inform you that it is a new species. If, according to the supposition of the local people, you can find one of double size, this will break the toads' world record, *Bufo asper* of Malaya being the only competitor . . ." Of course, the toads would still have to bow to the African frog, *Rana goliath*, but we were really making progress.

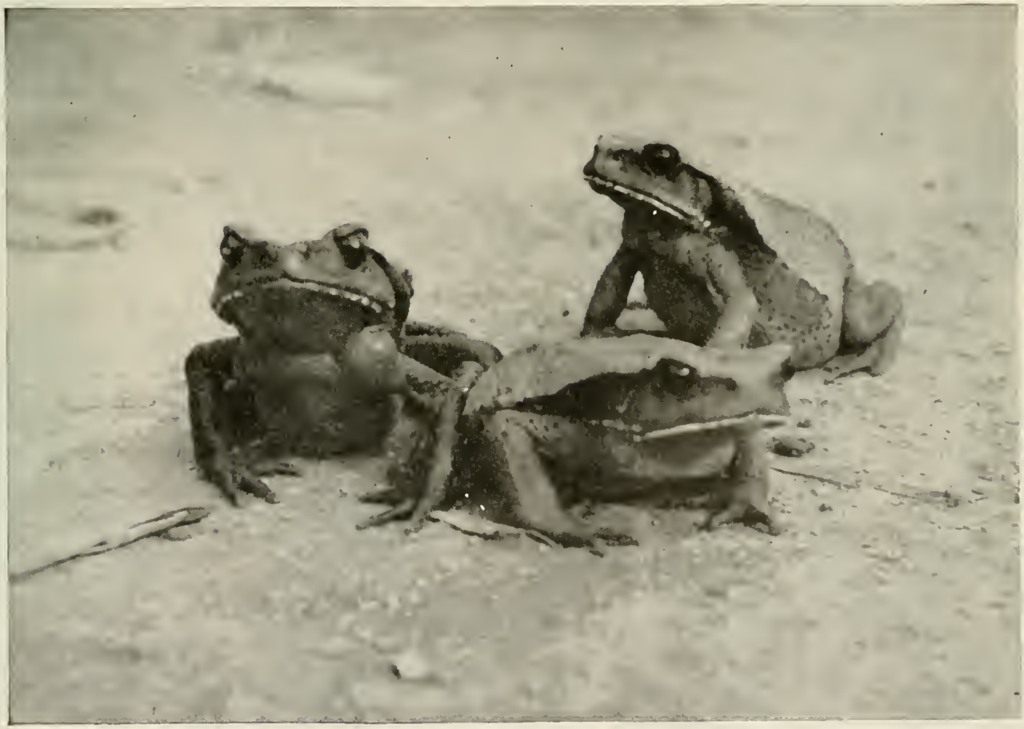
The good news sent me off on a second expedition. This time, I traveled farther west and entered quite tropical regions. My catch this time was three toads, the largest of which measured slightly over 9 inches (230 mm.) from snout to vent. Thus in length it ties for first place with one other toad from South America—a *Bufo marinus* from British Guiana, now in the collection of the American Museum of Natural History—though the latter appears to attain greater bulk.

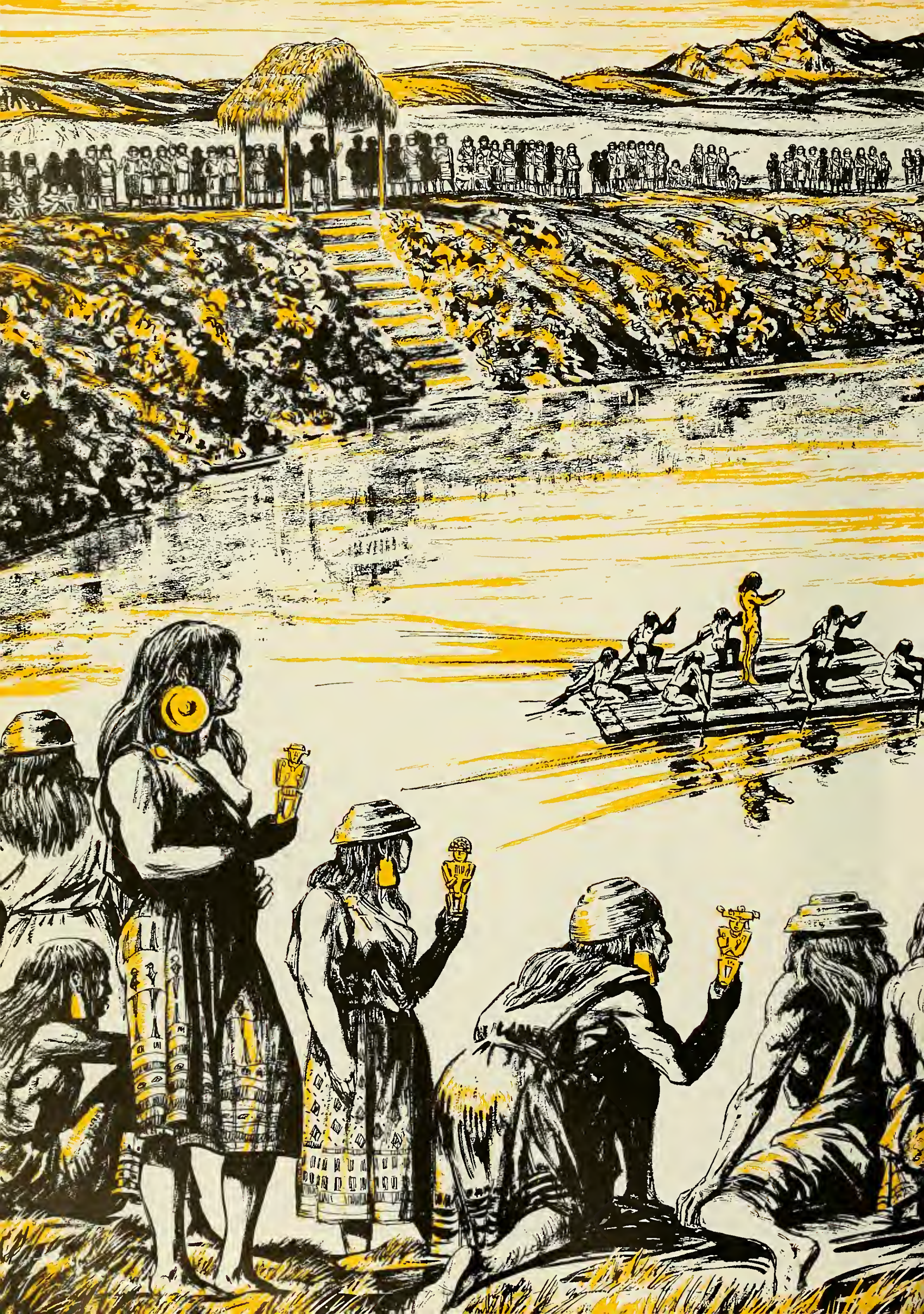
There is a good chance that still larger specimens will be found, because the people of the toad country continue to insist that they do exist.

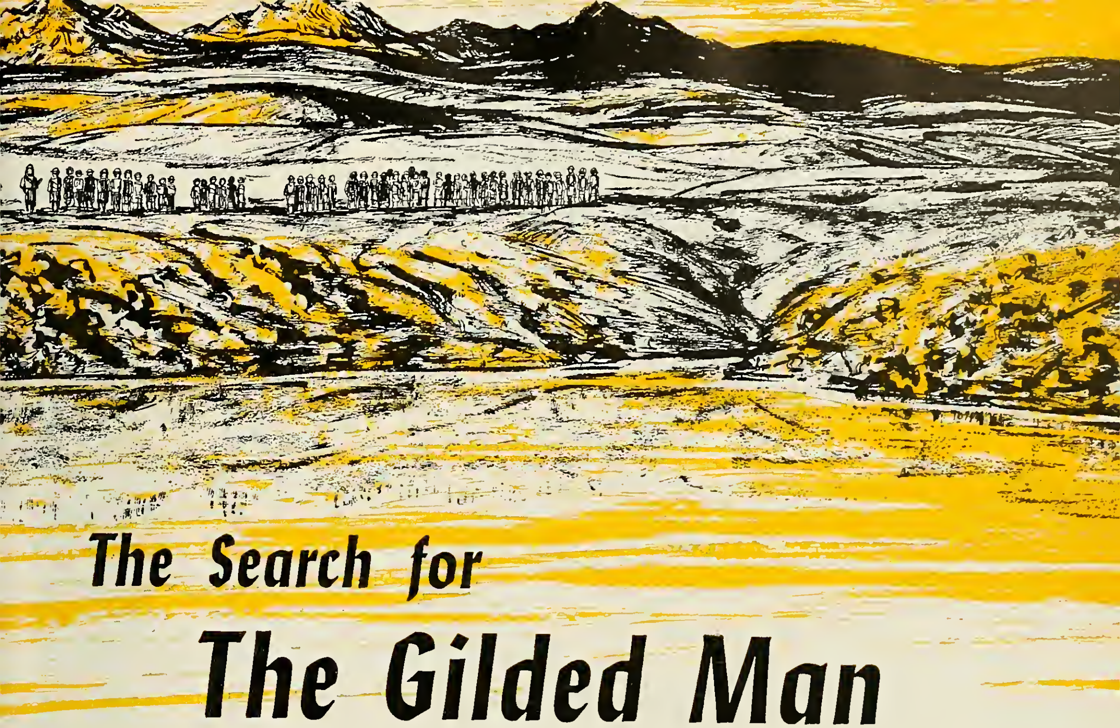
I brought the three beauties back alive, and from Ipiales I sent them by air to the Bronx Zoo in New York, where they appear to be thriving.

This story proves that one should not completely dismiss all the strange stories one hears. Nature yields her secrets reluctantly sometimes, and there is much yet to learn about these giant toads.

▼ A LATER EXPEDITION farther west in Colombia resulted in the capture of three more of the giant toads. The head and body of one totaled nine inches in length







The Search for The Gilded Man

Out of the mists of the Colombian Andes, out through the gloom of the jungle came a legend of gold. It dazzled the boldest adventurers of the Spanish Main and changed the course of history

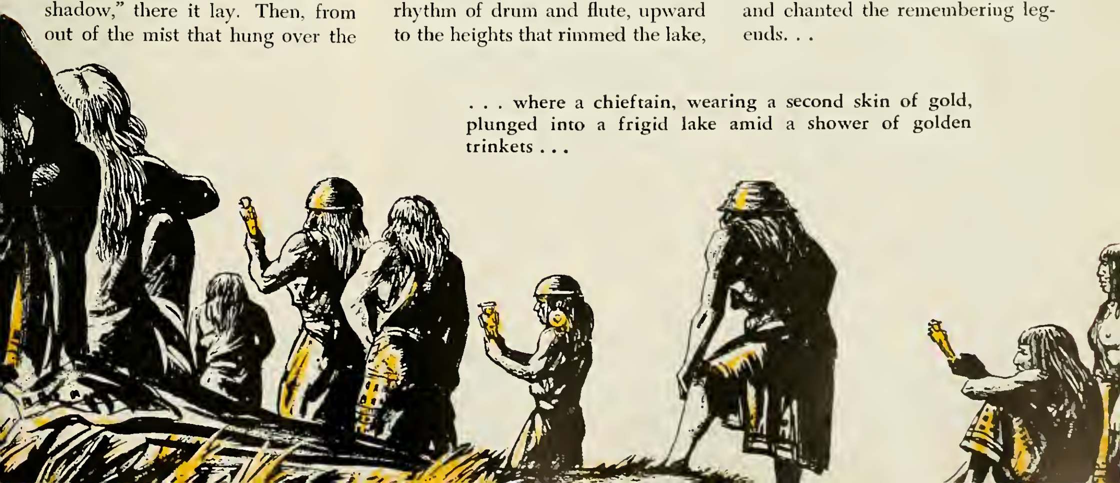
By VICTOR W. VON HAGEN

Drawings by Matthew Kalmenoff

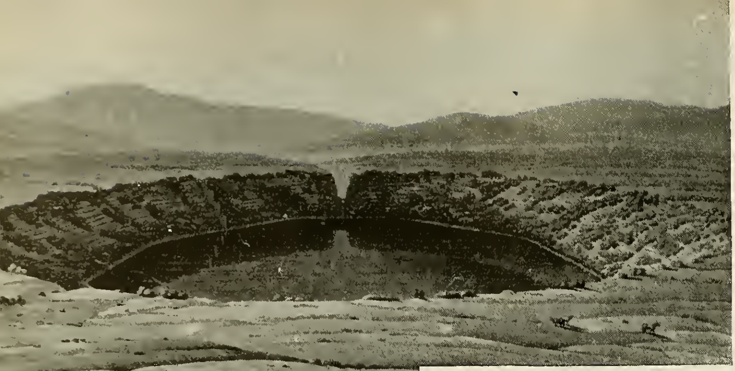
The Lagoon of the Gilded Man

IT sat there deep and desolate, round as a cup set to catch the first rays of the sun—the lagoon of Guatavita. "Over the mountains of the moon, down the valley of the shadow," there it lay. Then, from out of the mist that hung over the frigid valley, 9000 feet high in the Colombian Andes, files of Indians came dancing out of the fume and swarming in from the four directions, converging on the sacred lagoon.

They climbed slowly, to the rhythm of drum and flute, upward to the heights that rimmed the lake, and there looked down upon it 50 feet below. As round as a silver wheel, a quarter mile in diameter, it appeared to be a discus of beaten silver as the tender sun played upon it. As they waited for the ceremony, the priests throbbed their drums and chanted the remembering legends. . .

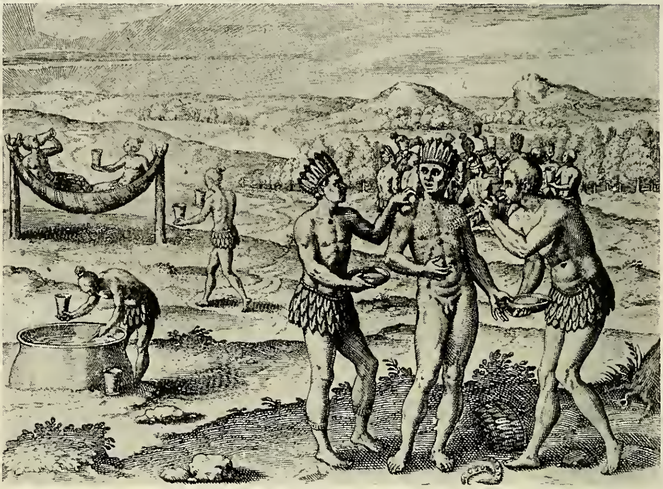


. . . where a chieftain, wearing a second skin of gold, plunged into a frigid lake amid a shower of golden trinkets . . .



◂ **Lake Guatavita**, scene of the ancient ceremony, as sketched by the great Alexander von Humboldt

From Humboldt's Atlas, *1810*



▾ **Gold dust** was blown onto the resin-coated body of the Gilded Man as shown in this de Bry engraving. Background details are partly imaginative

From Hakluyt's Collectiones

In olden days the Zipa, their king, impaled his wife's lover and forced her to eat his flesh while listening to songs made for the occasion. Then the Zipa forgave her. But she, upset by the needless cruelty, ran from him with her girl-child and threw herself into the lagoon of Guatavita. Below, she took up a new life with the Snake Dragon.

Now, each year, so sang the chant and so went the custom, the Zipa came to propitiate her with offerings of gold and emeralds. All this was told in song by the priests, while the Indians, spangled with golden ornaments, stamped their feet on the earth and chanted the songs of the Sun King. The Zipa was carried to the edge of the lake on a golden litter. He was helped from his cotton tunic, and the priests hovering around him applied a sticky, resinous substance to his body. Then the Zipa was ceremoniously rolled in a bed of gold dust. And so he emerged as the Gilded Man, a man with "a second skin of gold." Accompanied by the gold-spangled priests, he walked down the stone causeway, climbed onto a raft, and was wafted by the paddlers to the center of the lagoon.

There, reflecting the sun from his skin of gold, the Zipa threw his golden body into the air and plunged deep into the frigid lagoon. When he broke the surface and was pulled onto the raft, the Indians who crowded the rim of the lake broke out in wild chorus and rained into the lake the golden ornaments they had brought for the ceremony. Thus was it born, the "lunacy" of El Dorado, the tale of the Gilded Man—a story that was to shape history.

Conquistadors were to lead thousands to their deaths, wandering over fen and bog in search of the Golden Man. The Amazon would be discovered because of it; Sir Walter Raleigh would add Guiana to the English Crown in consequence of it. Half of South America would be pervaded because an Indian chieftain, "naked, but covered from his head to his feet . . . with . . . a second skin of gold," performed his ablutions amid a shower of golden trinkets in the frigid tarn of Guatavita.

This extraordinary ceremony of the Chibchas was seemingly known to many of the tribes that encircled their realm, for the Chibchas had an extensive trade. Such was necessary in order to procure the immense amounts of gold and gold dust that were required for these strange rites. Indeed, the Chibchas themselves, living in the high tablelands of the Colombian Andes, had neither gold nor silver in their territory; it was even too high for them to grow cotton from which to weave the scanty tunics that clothed them.

A vigorous, well-developed, copper-skinned people, the Chibchas had large dark eyes, marked with

the "Mongolian tilt." Clothing was simple: the men wore a loincloth and a long cotton mantle tied at the shoulder. The nose was pierced, and crescent-shaped ornaments hung from it. The ear lobes were punctured, extended, and plugged with golden ornaments. The women, barbarically handsome, wore a wrap-around and about their shoulders a strikingly designed cotton stole, held together by a large golden *tupu* pin upon which their goldsmiths lavished their finest art.

As a tribe, they numbered less than a million and lay scattered in settlements in the upper drainage of the Magdalena River. Their houses were of the utmost simplicity. The walls were made of reed daubed with mud, the roofs of grass, and there was a palisade as protection. Despite their rusticity, the Chibchas were a political tribe; they were governed by two realm-leaders who divided the lands between them. Over and beyond the subsistence agriculture—corn, beans, and potatoes—they had only two things with which to trade. But through these they acquired all the gold that transformed their community into the golden kingdom. These two minerals were salt and emeralds.

Emeralds were obtained at Muzo, where a huge mountain of limestone and gneiss was the only source of emeralds in the Americas. Emeralds, passing from hand to hand and tribe to tribe, reached Panama, where the Coclé Indians fashioned them into spectacular jewelry. They even entered Mexico, for in the spoils of the Spanish conquest, a chronicler relates that they found a "fine emerald as large as a man's palm . . . square cut and ending in a point like a pyramid." Cortes himself had five emeralds, taken from the Aztecs, which he valued at 100,000 ducats. Out from the Chibchas, emeralds were traded down the entire length of the Andes.

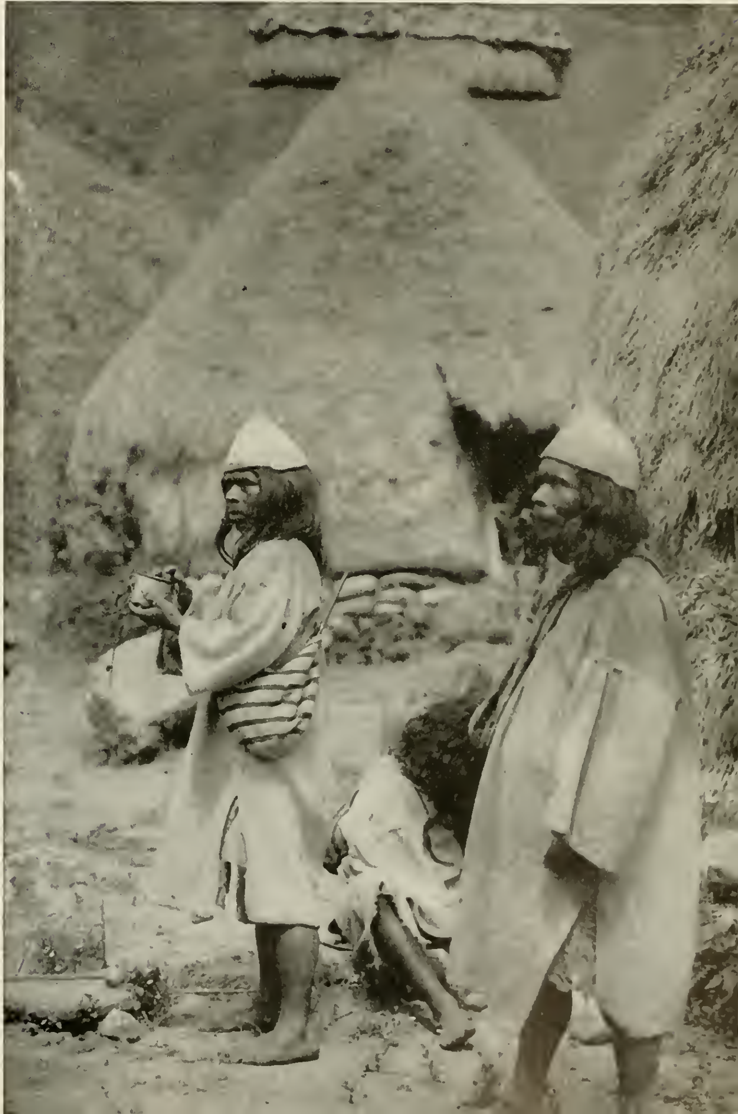
Then, after emeralds, the Chibchas had salt. Of all tastes—salt. The movement of salt has been one of the great life lines of history. All grain-eating people have valued it for its preservative qualities and for its appetizing virtues. Early America was tied to the coast by the bond of salt; but the Chibchas were free of that bondage. They had at the site of Zipaquira a mountain of salt. Boiled down in pottery pans, it was traded all over Colombia.

So it was that in 1536, a large Spanish force, bent on conquest, was following these salt trade lines, moving up after the salt "that was white like lumps of sugar . . ."

The Lawyer

. . . And he looked very well in his velvet cloak and gilt helmet, decked with waving plumes, while leading his men through the jungle —men athirst for gold and "ravenous for greater discoveries." Gonzalo Jiménez de Quesada, at 36 had changed in one leap from an advocate in the Spanish law courts to a general on horseback. He had started out, on that memorable day in April, 1536, with a force of 875 men, many attired in silks and scarlet cloths "and Perpignan hats with curled feathers." The whole of the

Victor W. von Hagen photo



➤ **Living reminders** of the legend: Cagaba Indians of Colombia, who dress much as the Chibchas did

➤ Figurine from Guatavita

GOLD FROM GUATAVITA AND NEIGHBORING REGIONS

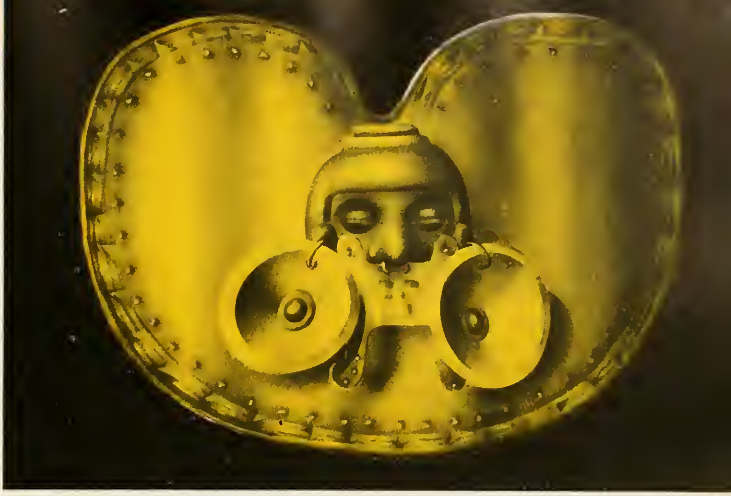
Frog necklace made by the Quimbaya

▲ Decorative piece (Popayan)
▼ Chest ornament (Quimbaya)

▲ Stamped Quimbaya ornament
◀ Chibcha ornament, Guatavita

colony of Santa Marta by the sea of the Caribbean turned out the day they shaped their way toward the interior, for they were marching toward a land where "emeralds lay on the ground like pebbles." Although the Santa Marta colony had been founded in 1525, no one had penetrated more than 100 miles in any direction. Now one of the largest armies ever assembled in the New World was marching off to find riches that might rival those of Peru.

It was to be only a matter of weeks before death and desertion would reduce the army to half its original size. By the time they reached the banks of the Magda-



A realistic head design of the Conto Valley (Quimbaya)

lena River, buoyed up with the hope that ships would meet them, they were already in a state of exhaustion. The ships never arrived, so they continued their hellish march southward and upward.

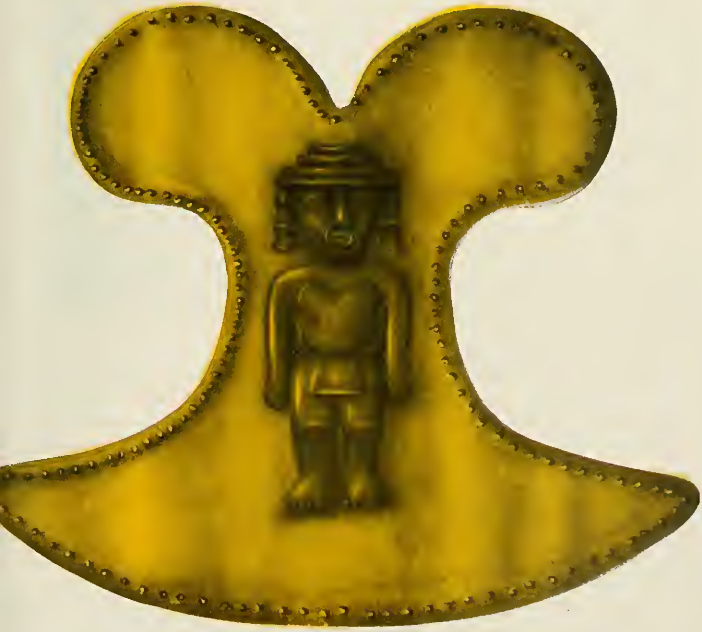
Now, after some months, the emeralds of which they had long heard rumors actually began to appear. Frequent clashes with Indians were yielding them golden trinkets as well. But death had gone on thinning the army of conquest, so that by the year's end, there were only a few left who had the strength to swing mattock and machete. Less than 200 worn, bleeding, tattered soldiers out of the original 875, they resembled more the ragamuffin army of François Villon than an expedition of conquest. Their hands clutched like live tendrils at the ragged fringes of the garments of those in front of them, but they mounted the escarpment and gained the tablelands of the Andes.

There Jiménez de Quesada, assembling his battered forces, faced the Chibchas. The conflict was fierce and brief. The Chibchas, with lance and sling, were no match for Spanish tactics and Spanish cavalry equipped with arquebus and petard. And within hours after the battle, they heard they were close to the lagoon of the Gilded Man.

So there they went, led by an Indian guide, "intelligent and agile." Full of hope, they camped beside the lake of Guatavita. There was nothing to be seen except the cup-round lake, a small hut, and a series of stone steps that led from the rim to the edge of the lagoon. What could the Indians say under torture? Only that this was the lake of the Gilded Man and that the treasure was under the water.

So, since the Spaniards were conquistadors and not engineers, they left and set off to chase their golden dream elsewhere.

They found it at Tunja, some miles to the east of the lagoon. It was a wondrous sight. From every ridgepole in the clustered village hung sheets of gold, beaten as thin as paper. The gold swung in the breeze, giving out sounds like an aeolian harp. The Indians, who gave them brief encounter, were clothed in gold. The priests wore beautifully worked golden pendants and diadems of plumes with quills sunk into golden fillets. The ears of everyone dripped golden ornaments. The men wore emeralds the size of walnuts, and from the nose hung ornaments so grotesquely large that they gave a metallic ring to their speech. Thus were the



The drawings of the golden ornaments appearing in this article were all made for the author by Luis Alberto Sanchez of Bogotá, Colombia. The pieces are representative of all of the Golden Kingdoms of Colombia golden appetites of the conquerors whetted and satisfied.

It took the better part of two years for the lawyer-turned-conquistador to follow out all the paths of the golden hoard. The conquest had yielded profits—gold plate enough to fill a good-sized room and, by Jiménez de Quesada's own count, 1185 emeralds. So a city called Bogotá was founded and a rude church erected even while the gold was being sought. All was going well until that day in February, 1539, when a knight rode in to tell the surprised Jiménez de Quesada that another Spanish force was on its way to Guatavita. The legend of El Dorado had brought the lawyer a competitor.

The Donkey Boy

An old hand at conquests, he had almond-shaped eyes, a touch of Moorish blood, and was at fifty-odd years swarthy, strongly built, and black haired, and he flaunted an arrogant air. Sebastian de Belalcázar's life read like a fairy tale. In his youth he was a donkey boy; once when the recalcitrant beast was stuck in a mud hole and did nothing to extricate itself, Sebastian had become so angered that he struck it a blow in the face that killed it. When faced with the choice of punishment or flight, he flew to the port of Cádiz, the debarking place for expeditions to the New World. As he had no other name than "Sebastian," he was entered on the ship's list as from "Belalcázar," from that nursery of conquistadors in the Spanish province of Estremadura.

He adventured in Panama, learned to fight Indians, and moved on to Nicaragua, where he became a founder of the city of León. There he listened anew to the voices of the sirens of conquest, and he was recruited in 1530 by the Pizarros for the business in Peru. Later he moved on toward Quito, slaughtering the Indians in handsome manner, and there he founded in 1534 the modern city of Quito. Thus did the one-time Donkey Boy gain his spurs of conquest.

Sebastian de Belalcázar was resting in the town of Latacunga when a Spaniard brought him an Indian on embassy to the Inca of Peru. The Indian came, he said, from the north at Cundinamarca, where his liege was so powerful that he bathed in gold dust. As he spoke, and it was translated, one of those present picked up his lute and transcribed as a troubadour the song of El Dorado:

"An alien Indian,
hailing from afar,
Who then in Quito resided
Claimed to be from Bogotá.
He gave talk to Belalcázar
and announced
Things of his country, rich in
emeralds and gold.

Also among the golden things,
Was a certain king who dismantled,
Went aboard a raft so as to make
Ablutions of himself.

On his regal form (as he had seen)
A fragrant resin
And upon it, a coat of powdered gold
Golden from foot to highest brow
So that there he was,
as resplendent
As the beaming sun.

People without end,
the Indians said,
Came there to make rich offerings
Of golden ornaments and of emeralds
And diverse other trinkets.
All this he affirmed with worthy credence,
So that Belalcázar's men, then light of
heart
Called this king, El Dorado.

And so, by that name
and by countless ways
El Dorado spread all over the world."

To this information, Sebastian de Belalcázar, to whom life was one long adventure, replied: "Then let us go and search for this Golden Man." And so they did.

Years later in the Neiva Valley, in February, 1539, the forces of the Donkey Boy and the Lawyer met. Incredible, the meeting of two forces at a pin point in the labyrinth of the New World! Still more incredible, however, was something else. Another group of Spaniards, as wild-looking as the jungles, wearing animal skins and riding horses lean and travel-worn, descended upon them. Six days after the first two forces had met, the third, as part of this true fairy tale, came upon the scene.

The German

"I, Nicolas Federmann the Younger, of Ulm, was appointed by the Welsers, as a captain of 120 soldiers and 3 German miners, whom I led across the Ocean Sea to the country of Venezuela, whose dominions His Imperial Majesty had ceded to the said Welsers, my masters." And so, in this fashion, had come red-bearded Federmann to South America.

As he moved along the tropic shores of Venezuela, he too heard of a king in the west who walked in a skin of gold. So, with 400 men and an absurd disregard for the realities of geography, he set off for the evening land of the Andes.

They crossed the burning llanos, moved up the Apure River, and skirted the jungles, fighting Indians and fever all the way. For three and a half years they marched, moving through a labyrinth of trees and rivers, following the will-o'-the-wisp—that Golden Man. Indians, numerous and bold, challenged every step, and death thinned their ranks. Still Federmann urged his men on. They were reduced to only 100 starving skin-clad warriors when they burst out upon the savannas that led to the lagoon of the Gilded Man.

An unbelievable destiny seems to have tied these three human knots together on the summit of the Andes—three distinct armies of conquest, coming from three different points of the compass, meeting at the same spot in the middle of the incognita of the Andes. All three groups were in search of El Dorado, that

dazzling symbol of inexhaustible wealth. And the wonder of that meeting never left the memory of the red-headed German who led that dreadful march across the continent. When he returned to Europe, he wrote a "Charming and Agreeable Account of the First Trip of Nicolas Federmann the Younger of Ulm to the Indies . . . and All that Happened in that Country until his Return to Spain. Written Briefly and Diverting to Read . . ."

With the wonderment still fresh, the three captains praised God, even while standing knee-deep in Chibcha blood. They embraced, promised each other eternal fealty, and left for Spain, where each proceeded to litigate for the territory of the Gilded Man.

The Myth of the Golden City

The vision of an El Dorado, the golden city of a golden realm, grew with the passing years, until the legend no longer described merely an extraordinary ritual of a tribal chieftain who smeared himself with gold dust. Now, inflated by the behemoth of the imagination, the tale created a Golden City; and its name was Manoa.

Within a decade, the dream of this city set in motion more treasure-hunting expeditions than the world had ever seen. From the country of the Incas, Gonzalo Pizarro, brother of the Incas' conqueror, made off with a well-appointed expedition into the jungles beyond Quito in search of it. "After boiling our saddles in herbs for food," as he put it, "we set off for the Kingdom of Gold." They discovered something quite different. Although he was left stranded in the jungles, his companion Orellana sailed into immortality by floating down and discovering the Amazon River.

Then Pedro de Ursúa took his impatient regiment of myrmidons in search of El Dorado, across the Andes, down the Amazon, and over into Venezuela, on an expedition so fearful that it reads like legend.

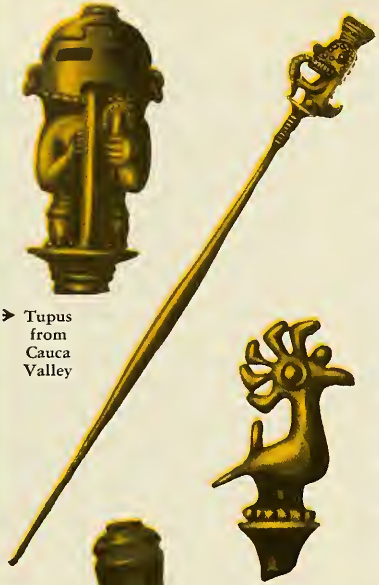
During the latter part of the sixteenth century the search for El Dorado devoured men and money. It so possessed Spain that their King had at last to call a halt for fear that it might depopulate his kingdoms.

Then, just about the time that the Spaniards grew weary under the cost of pursuing this *ignis fatuus*, Sir Walter Raleigh arrived in Guiana to lead a fantastic expedition to find the El Dorado. Although he was well aware of the catastrophe that had overtaken all the other treasure hunters, he felt that his own venture was, in his Elizabethan words, "Feasible and Certaine." For now, little quarter-mile Guatavita had grown to be a huge lake called Parime and located thousands of miles from its original site, somewhere between the Amazon and Orinoco River. It was the "mighty and rich and beautiful Empire of Guiana" in the words of this dangerous and magnificent man, and he spoke knowingly of "that great and golden city which the Spaniards call 'El Dorado'" and of "a country which hath more quantity of gold by manifolds than the best parts of the Indies and Peru." Thus Raleigh fared forth.

Instead of Manoa, Raleigh gave Guiana to the British Crown, and in

▲ THE CUT made by Fonte and Sepulveda at the end of the sixteenth century. It lowered Lake Guatavita enough for them to recover 6000 ducats of golden images

➤ THE AUTHOR drinking at Guatavita, into whose muddy cup-shaped bottom most of the gold pieces have sunk



➤ Tupus from Cauca Valley

the process he lost his magnificent head.

Death of the Chibchas

Yet those who suffered most in this frenzied search for the myth were the inventors of the fable—the Chibchas. Their villages were decimated by the demands upon them, for every time a Spanish capitan thought up a new junket, the Indians would be gathered up, crotcheted together with iron manacles, and forced to carry the impedimenta of the expedition. With all this upon them, the Chibchas, as a tribal entity, soon melted away.

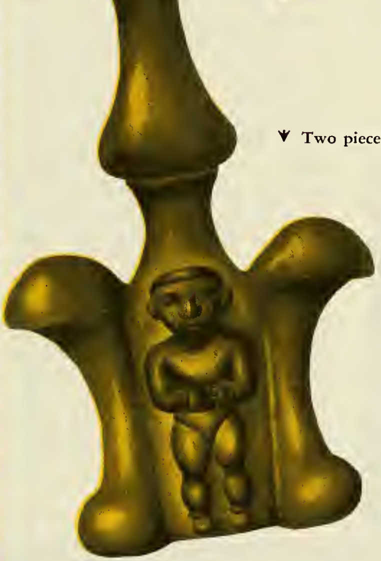
Their whole culture simply dissolved. Those who were not swallowed up lost their tribal identity, then their language. Not a monument was left above the ground; no traditional arts remained behind; no lasting influence survived their demise. Except for some names on the land, such as Facatativa, Fusagasugá, Guatavita, the Chibchas vanished.

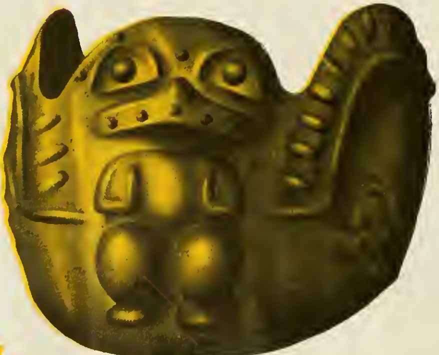
This, then, makes all the more remarkable the profusion of golden ornaments that they, as well as the other related cultures in Colombia, produced.

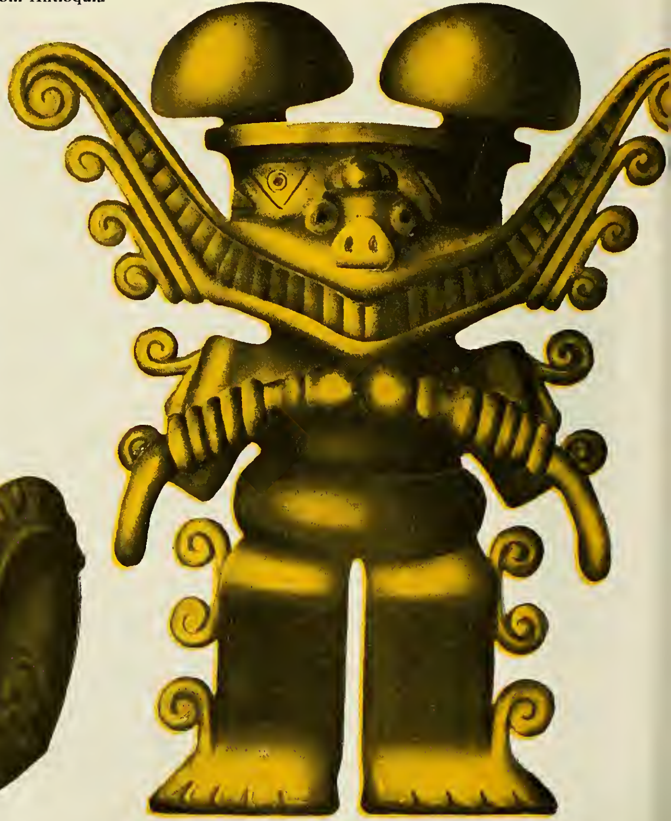
The Golden Kingdoms of Colombia

The Chibchas, whose golden culture was technically inferior to some of the others, made up for this in the pure mass of gold work. Their chieftains, ornamenting themselves with all the metallic trappings of barbaric kings, demanded golden tribute from all subject villages. Everything was gold-studded, from the scepter of their ruler to the mummies of their ancestors, whom they carried into battle. Gold was the symbol of Kua, the Sun God, and was used to delirium. Most of the Chibcha gold, or the por-

⮟ Two pieces from Antioquia







tion that survived, was etched or stamped *à la repoussé* with designs that first had been carved on stone. Another technique, an elementary one in goldsmithery, was the casting of crude anthropomorphic forms, in which an attempt was made to fit into a three-dimensional art form figures that had only two dimensions. These small figurines, called *tunjos,* with limbs and features made of thin gold wire, were the trinkets most commonly cast into the lake of Guatavita. Hammering golden plates of gossamer thinness was another Chibchan technique; the sheet of gold was gently pounded over a stone so that it became embossed, in alto relievo, with the design of the stone mold.

It was on the fringes of the Chibcha territory that goldsmithery reached its highest form, in those culture areas known to the archaeologists as the Tairona, Sinu, and Quimbaya. The Quimbaya lived in the Cauca Valley, where a verdant vegetation has been produced by the alternation of sun and drench. In speech they were related to the Chibchas, but they lacked their numbers and political organization. The Quimbaya were master craftsmen, as the surviving gold work suggests, and they lived in a rich gold-bearing region.

Gold was cast into superbly molded figures; gold was smelted, forged, and cast in molds. The lost wax process—cire-perdue—was extensively used; gold was hammered into exquisite filigree, and even white and yellow gold were combined for effect. Jars, bottles, and human figures extraordinarily true to life were cast, as were glittering nose and ear ornaments. There were breastplates inlaid with emeralds, and pendants and diadems were cast by the Quimbaya goldsmiths. They made golden bells, bracelets formed of *repoussé,* and beads hollow and solid. There were golden *tupus* to hold together the edges of a woman's mantle, of special interest because of the finely cast figurines at the top. They plucked their meager facial hair with golden tweezers, they cast or hammered golden masks for the mummies of their dead, and out of cuttings of gold they made nose ornaments, crescent-shaped bangles.

It was much the same almost everywhere else in Colombia. The Spaniard found, if not on the person of an Indian, then in the precincts of their sacred tumuli, a golden hoard that would have satisfied Croesus. "Images of every kind," said a Spaniard, "every kind of animal from man down to the ant—all of the purest gold."

Still, not all of this was lost to the crucible when the Spaniards melted it down into golden ingots. Much survived the holocaust of conquest; and in a museum maintained by Colombia, in the lower vaults of the Bank of the Republic, one can see today thousands of these golden pieces, the very mass of which remains as impressive as the design itself.

The Treasure Lagoon

How had all this treasure survived the voracious appetites of the conquistadors? Only by remaining in its watery grave within the sacred lagoons selected long ago by the Chibchas as its repository. For the dream of El Dorado eventually evaporated, and within half a century or less the conquistadors had skimmed off all the gold except that which had been buried in some secret cache. Only then did the Spaniard realize that what the Indian had told him had been true in the first place—that there was no original gold source in Chibchaland; all that they had seized had come through barter with other tribes. For this reason, subsequent expeditions had fanned out to neighboring regions.

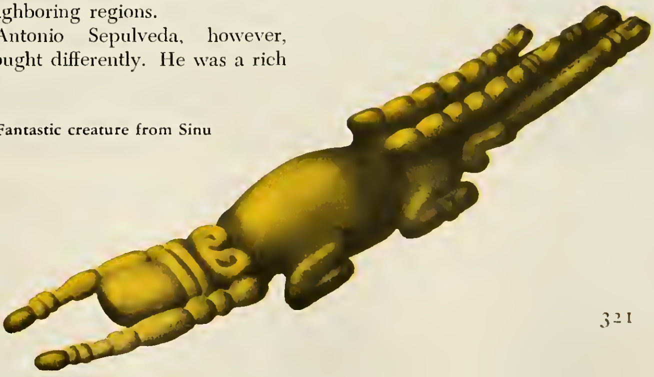
Antonio Sepulveda, however, thought differently. He was a rich merchant living in Bogotá and had, for profit or pleasure, sifted the accounts of El Dorado. He became convinced that El Dorado and its gold were where the Indians had said they were—at the bottom of the lagoon of Guatavita. After a preliminary investigation around the edges of the lagoon (which yielded enough to whet his interest), he took the long journey to Spain in 1580. There he convinced the King's ministers of the feasibility of draining the lake, and, promising to see that the Crown would have its royalty—"the King's fifth"—he rekindled the fire of the legend of El Dorado and raised what he believed to be the necessary capital. Thereupon he returned to Bogotá to begin his Operation Gilded Man.

Displaying the royal seal, he raised a labor battalion of unenthusiastic Indians and set them to work, with mattock and crowbar, to cut the 50-foot earth and stone wall that encircled the lagoon. After months of exhausting work, the cut reached the surface and the water poured out, lowering the level of the lake and, in the process, exposing the thick black alluvium. In it Sepulveda found a considerable number of golden trinkets and an emerald "as large as a hen's egg." But the surface had to be lowered farther.

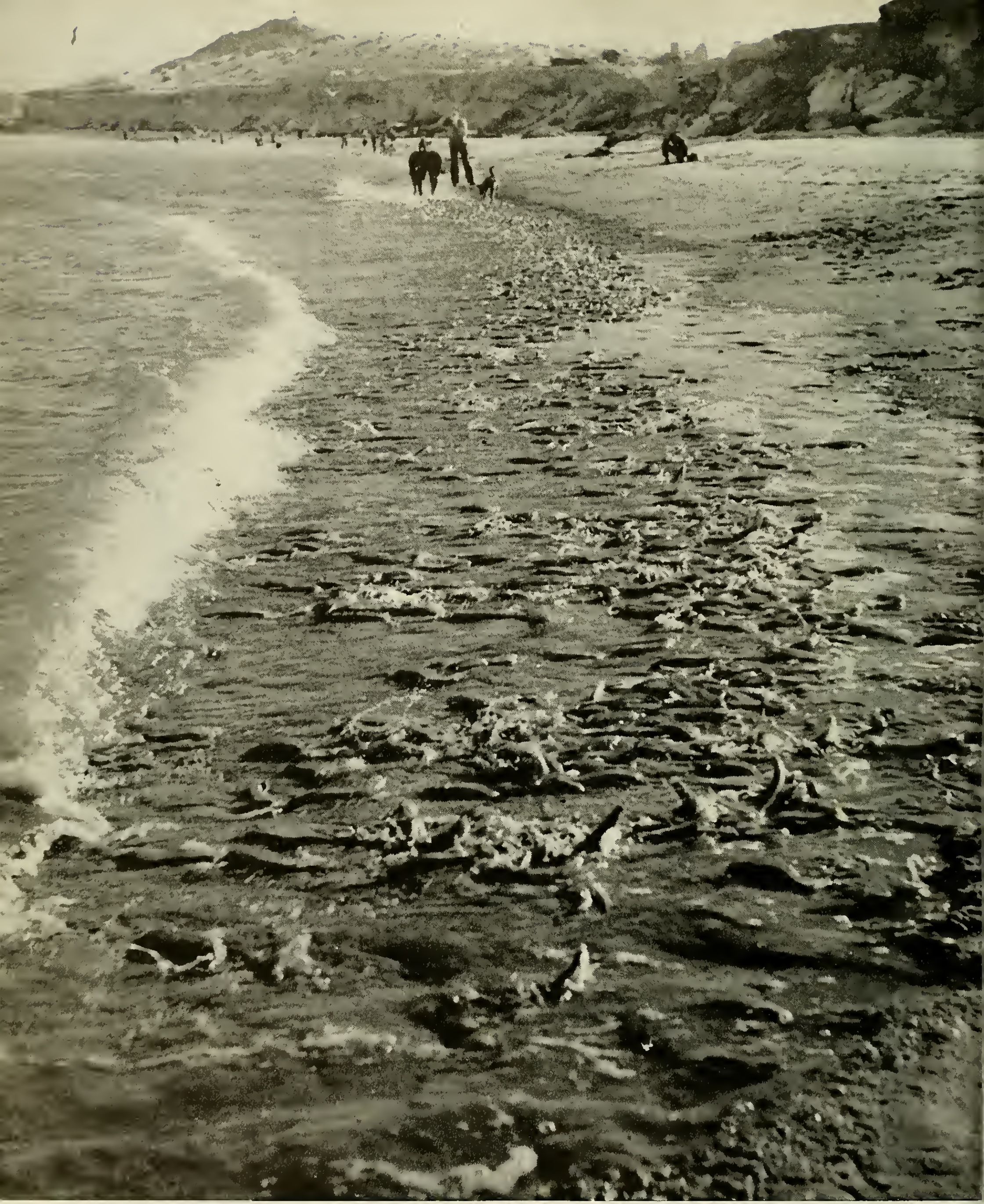
Then, just as he found an emerald-studded scepter, his capital gave out. The Notary claimed all the gold in the King's name, and Sepulveda was "obliged to abandon his camp and workings to get him to a hospital to die, there being no means left him for anything else."

In 1625, they tried it again—

Continued on page 335



➤ Fantastic creature from Sinu



▲ A BEACHCOMBER'S DREAM. Bathed in warm sunlight, the grunion crowded onto the sandy shore at San Felipe. Many of the natives on the Gulf of California consider this a rare phenomenon

A Wave of Fish

The California grunion is famous for swimming onto beaches at night at certain phases of the moon to lay its eggs. This remarkable set of photographs shows its near relative in the Gulf of Lower California performing its nuptial "dance" *in broad daylight*—a habit unknown until recently

By ANDREAS B. RECHNITZER
Scripps Institution of Oceanography, La Jolla, California

Photographs by GENE DANIELS, from BLACK STAR

READERS of NATURAL HISTORY Magazine may recall having read of the curious fish known as the grunion, which swarms onto California beaches in unbelievable numbers at night to spawn.* These fish have never been known to make their appearance on the Pacific coast beaches during the daytime.

It is interesting to note, therefore, that on February 14, 1952, at 3:30 P. M., a near relative of the California grunion made a daylight spawning run onto the beach near the tiny Mexican fishing village of San Felipe on the Gulf of California. Vacationists were astonished to see hordes of the tiny fish wriggling on the sandy beach. A few persons who were present forsook their sun bathing or surf fishing to sweep vast numbers of the writhing fish into pots, pans, nets, or any other container that was handy. Mr. Gene Daniels refrained from picking up the grunion in order to take these pictures of the spectacular event.

On other occasions, as well, the Gulf grunion, as distinct from the California grunion, has been reported as spawning during daylight hours in the recent past. Mr. David G. Jessop, of San Diego, found grunion spawning along the beach just in front of San Felipe village on February 19, 1951, at 4 P. M. The tide was high and ebbing at the time the grunion were on the beach. And the late Mr. Fred H. Wylie, a keen-eyed observer, also witnessed daylight grunion runs but on the opposite side of the Gulf at Cholla Bay, on April 23, 24, and 25, 1951. Each spawning was in the late afternoon just after the peak of the tide. As the greater part of the Gulf of California is, at best, sparsely populated, it is not strange that reports of the day-spawning Gulf grunion have been few.

In daylight the fish are an easy prey for gulls. But when the high spring tides occur during daytime, the Gulf grunion appear to do their spawning with total disregard for the daylight, despite the dangers. The supply of grunion is often so copious that gulls have been observed to stand and mope because they could not find space for another grunion in their gorged stomachs!

With the exception of these occasional daylight spawning runs by the Gulf grunion, its life history probably resembles that of the California grunion closely, and the two species are superficially quite similar in appearance. However, the taxonomists classify them in separate genera. They are labeled the California grunion, *Leuresthes tenuis,* and the Gulf form, *Hubbsiella sardina,* both belonging to the silversides family Atherinidae.

Grunion are found nowhere in the world except on the Pacific

➤ NOTHING LIKE a grunion run to get one close to nature

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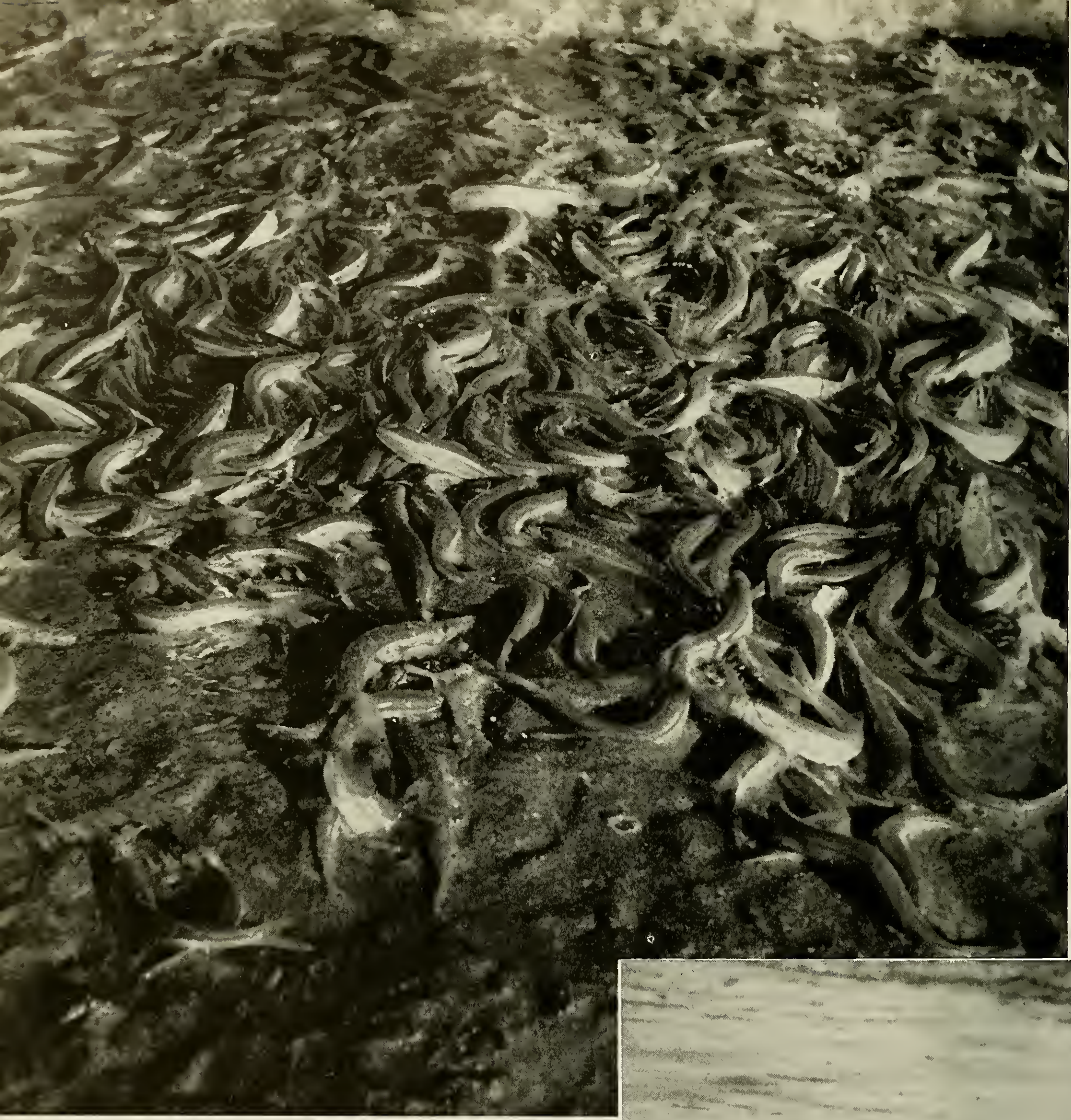
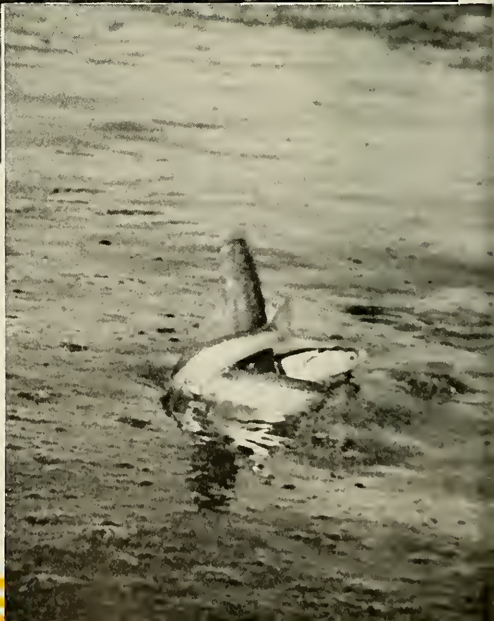
* NATURAL HISTORY for January, 1948.





▲ **Half buried** in the sand, the females appeared to stand on their tails

➤ **This unusual photograph** shows the actual mating of the grunion. The upright female is burrowing into the sand with rapid vibrations. She buries herself more than halfway, deposits her eggs, and returns to the water in 30 seconds. Two or three male grunion are curled around the female emitting their milt coast from Monterey to southern Lower California, and in the Gulf of California. The grunion spends most of its life near the sandy beaches, and during the reproductive season it avails itself of the upper wave-swept beach area for spawning. Only during the spawning season, from February to September, do the fish come onto the beaches.

As the entire spawning act takes place out of water, the complete sequence of events can easily be observed during a daylight run like the one shown here. The fish swim in with the incoming waves. As a wave begins to recede, the fish deliberately swim shoreward in order to strand themselves as high up on the beach as possible. The female starts to dig in tail-first while there is still water on the beach. By rapid vibratory movements of her tail, she buries half her body or more into the semifluid, water-soaked sand. This "digging in" is accomplished very rapidly, often before the wave has completely run off the beach.

The male or males (the number attending one female varies) assume a curled position close to the female. While the female relieves herself of ripe eggs about two inches below the surface of the sand, the male curves his body around her and emits milt onto the sand close to her body. Although the milt is not applied directly upon the eggs, almost complete fertilization of the eggs is accomplished. Upon completion of spawning, which requires about 30 seconds, the grunion work their way back toward the water by vigorous wiggling and flipping, which usually frees them. Succeeding waves often assist the grunion to return to the water.

The wonders associated with this unique spawning do not cease with the laying of the eggs. Further relationships between the sand movements and the egg pods have been described by W. F. Thompson. He found that the eggs were normally deposited a couple of inches below the surface of the sand, but by the following day they were some four or more inches below the surface. This change in depth was found to be due to the building up of sand on the beach with the recession of the tide. Thus, after the eggs are spawned, they are buried still deeper by a deposit of wave-transported sand. The eggs are then better protected from surface predators, such as the godwit, a common sand-probing shore bird, as well as from dessication, abrasion, and rapid changes in temperature.

In their moist sand incubator, which is not visited by waves for two weeks, the embryos develop. Usually in seven days the eggs are ready to hatch. Even though the young grunion has developed sufficiently for hatching, it remains within the protective covering of the egg until the incoming tide washes the egg free. At this more opportune moment, the fish hatches and takes its first swim.

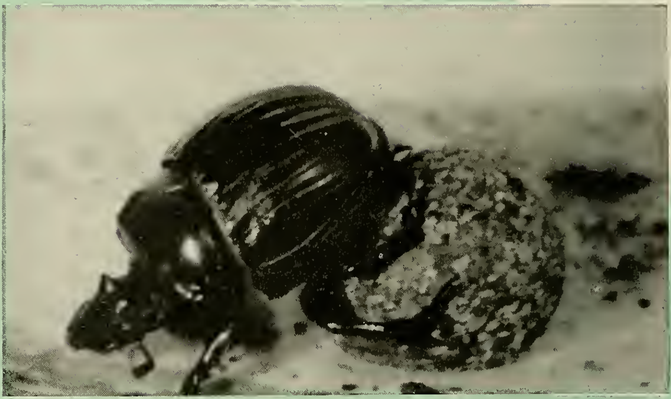
Apparently the egg has to be agitated in order to hatch. In the laboratory, eggs that were not agitated would go well beyond the normal two-week period, even though they were ready to hatch and were in water. After a little shaking, however, the tiny fish would scurry out of its egg case. The refusal of the egg to hatch until disturbed by a wave is of obvious advantage to the grunion.

The grunion's method of "going ashore" to spawn is unique among marine fishes and is bound to arouse astonishment in anyone who is fortunate enough to witness it.

HE GRUNION were not so easy to catch as might be imagined. n approached, they would skitter back into the surf

▲ MOST OF THOSE who caught the fish regretted the bounty when the time came to scale and clean them

➤ USUALLY the bug pushes the ball backwards, like this



The Strange TUMBLEBUG

Let others carry a nibble at a time and make many trips. The tumblebug rolls a ball as big as itself

By HALLIE H. HOLT

THE tumblebug is becoming extinct in many places. Modern machinery is proving a threat to its way of life. It doesn't know how to live without its "marbles," and it can't make them without fresh manure.

With its blunt shovel-like beak, the tumblebug cuts out a fresh bit of dung and tumbles it about until it looks like a marble covered with dust. Then it digs a hole and buries it. If it is early in the season, the insect goes down with the ball and lives beneath the ground until the ball is consumed.

In making the ball, the tumblebug sometimes pushes it with its front feet but more often with its rear legs, pushing backward. If the ball suddenly rolls over a bump or tumbles into a depression, the tumblebug usually takes a tumble with it.

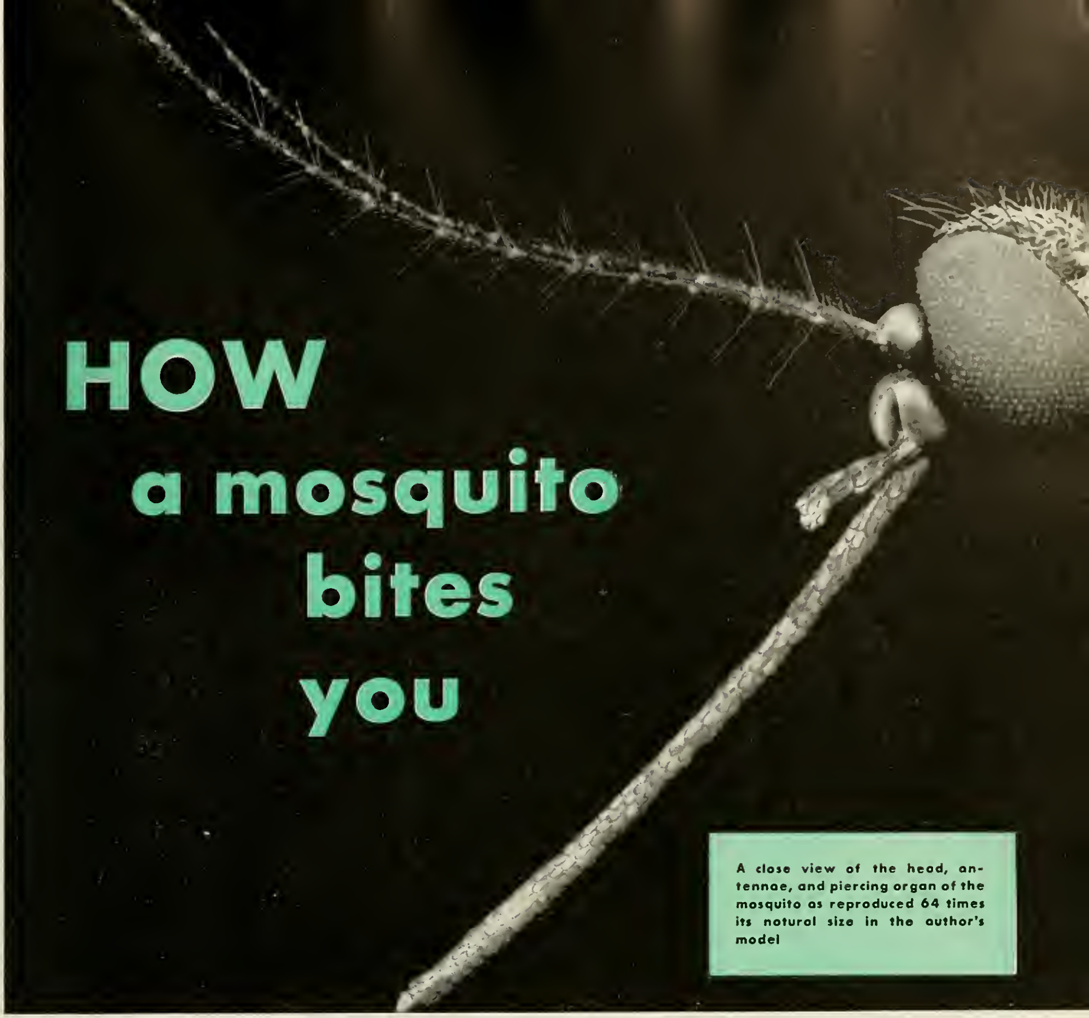
I do not believe that this insect's eyes are very good. I have seen tumblebugs fly against a gray-stone building and knock themselves out for some little time. Once I was watching one as it pushed a ball in a cow path on a hillside; it ventured too close to the edge, and the ball rolled down the incline. Though it stopped only ten or twelve feet away, the insect never found it. It hunted for quite a while but never once in the right direction. Finally it went back to the dung and started a new ball.

In the late summer the tumblebug makes a ball and lays an egg in its center. Instinct seems to cause the insect to roll the ball to a place where the soil is suitable and conditions are right to maintain proper moisture. The ball may be rolled quite a distance before it is buried and the hole carefully filled.

The egg hatches, and the larva feeds upon the contents of the ball until full-grown. Then it transforms into a tumblebug, breaks out of the ball, and comes to the surface.

One may see two bugs pushing the same ball. They usually work against each other and waste a great deal of effort. The great naturalist Fabre found that both bugs were often of the same sex. After studying them, he concluded that the so-called helper was only working for a chance to steal the ball from its rightful owner.

HOW a mosquito bites you



A close view of the head, antennae, and piercing organ of the mosquito as reproduced 64 times its natural size in the author's model

Most persons do not realize that the part of the "stinger" they see never penetrates the skin. The six tiny daggers that do the actual drilling are contained in a sheath

By CHRIS E. OLSEN*

With photographs and drawings by the author

THE lavishness with which nature has endowed the animals in all their complex adaptations is a source of endless wonderment among those who study living things. One learns this with special force when he seeks to produce a model of an insect. Recently I had occasion to study the anatomy and habits of our mosquitoes in order to build a 30-inch model of *Aedes vexans*, an obnoxious U. S. swamp mosquito. In this model, every part of the insect is enlarged 64 times, and you can imagine the precision of detail that had to be learned by microscopic examination.

The word "mosquito" is almost synonymous with "annoyance," and it may also remind one of dread and deadly diseases, such as ma-

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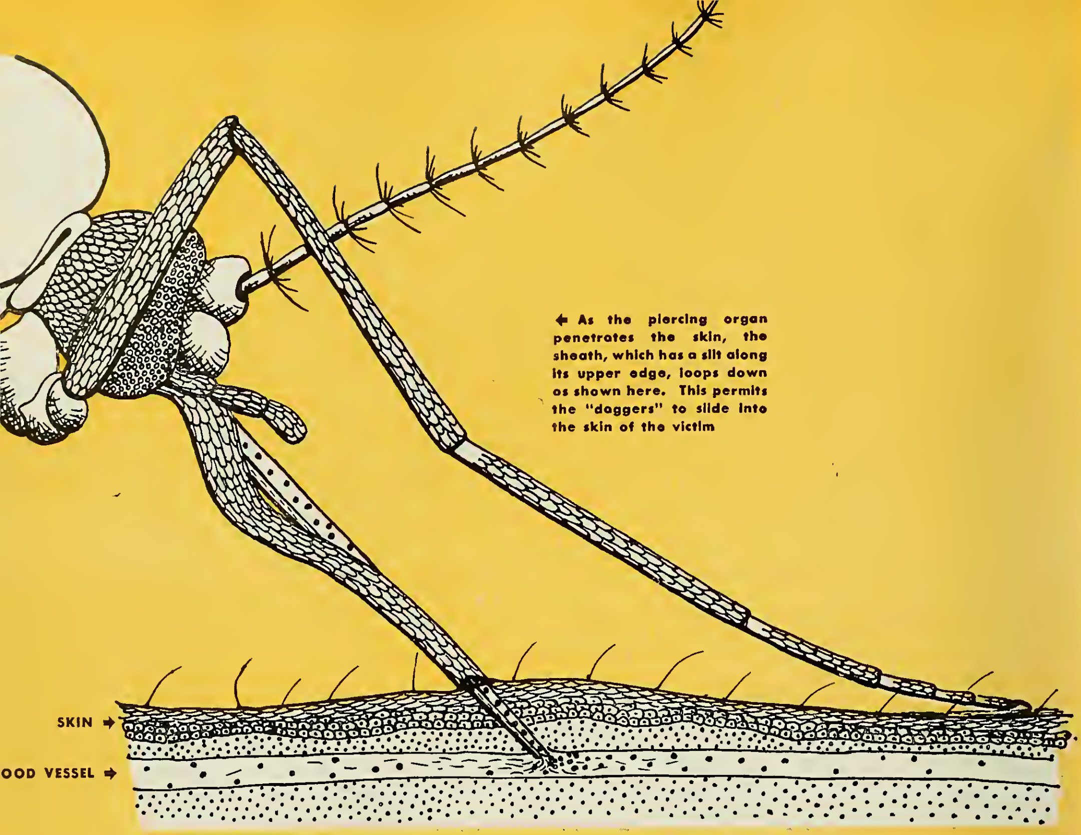
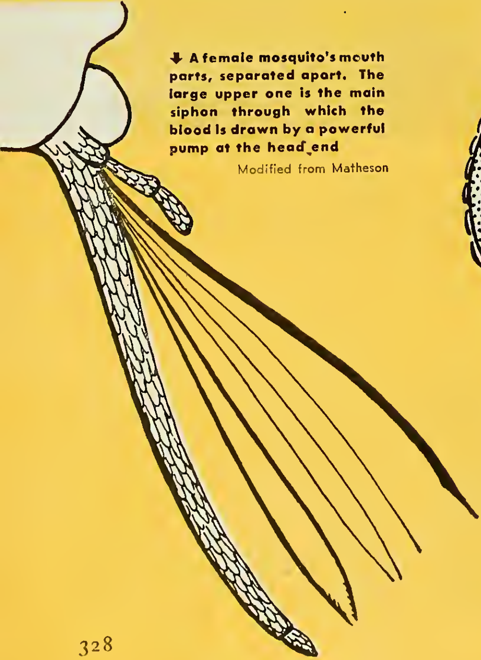
* CHRIS E. OLSEN has won wide recognition as a museum technician and artist. He devoted his talents for many years to a wide variety of projects at the American Museum of Natural History, and his outstanding artistry is seen in many exhibits, particularly in those portraying underwater life.—ED.

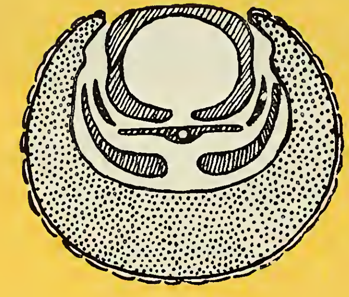


As the piercing organ penetrates the skin, the sheath, which has a slit along its upper edge, loops down as shown here. This permits the "daggers" to slide into the skin of the victim

A female mosquito's mouth parts, separated apart. The large upper one is the main siphon through which the blood is drawn by a powerful pump at the head end

Modified from Matheson

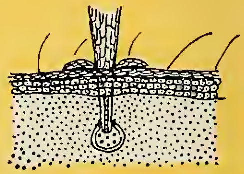




In cross section, the mosquito's piercing organ shows the relatively thick sheath, or labium, and the six enclosed daggers that penetrate the skin. The large upper "tube" actually draws the blood. The flat one nearest the center contains the small salivary gutter. It is through this that sporozoites are injected into the blood stream of the victim, if the mosquito is one that can spread disease

Modified from Matheson

Highly enlarged view of the piercing organs penetrating a blood vessel. Note the two small lips, or labella, spreading and gripping the skin where the tip of the sheath (the labium) touches the surface



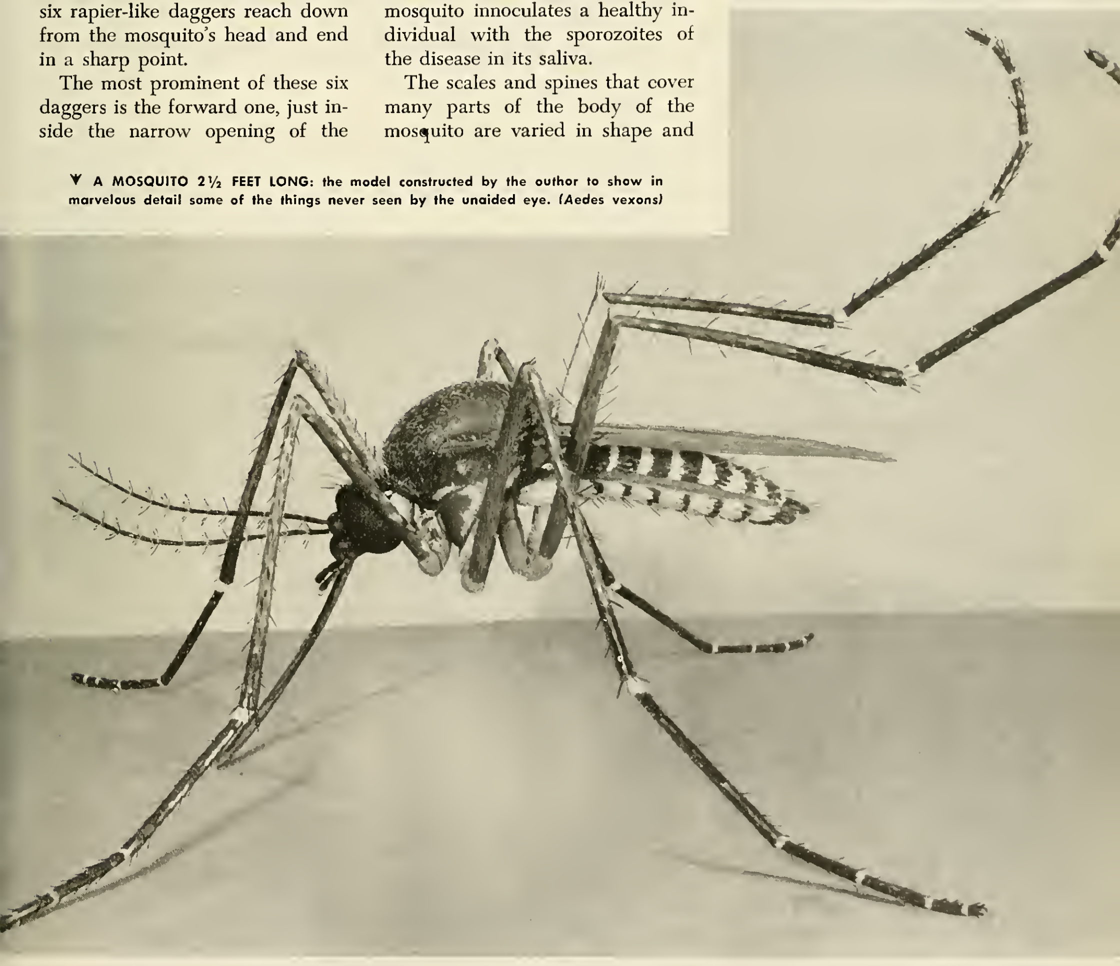
laria and yellow fever. The mosquito's beak or proboscis may not only be a siphon for drawing the warm blood of its victims but also a hypodermic needle for injecting parasites into the blood stream at the same time. Malaria or yellow fever can be contracted only through the bite of a female mosquito of the right sort.

The mosquito's proboscis is a far more complex instrument than most people imagine, as can be seen by a glance at the accompanying illustrations. In the first place, there is not one piercing organ but six, and these are enclosed in a flexible sheath, which is slit along the upper edge. Through this tube, or sheath, the six rapier-like daggers reach down from the mosquito's head and end in a sharp point.

The most prominent of these six daggers is the forward one, just inside the narrow opening of the sheath or labium. This is the real siphon, and it has a powerful pumping motor at the head end. Two of the other five daggers are supplied with a set of recurving barbs at the end, and one has a salivary gutter connected with the salivary gland. The needles dig rapidly into the skin to reach the blood vessel of the victim, and as they do so, the sheath separates from them near the head and loops out to allow the needles to penetrate. While the piercing organ penetrates the blood vessel, the short lips at the tip of the labium (the labella) spread out horizontally and grasp the surface of the skin. It is by means of the salivary gutter that the malaria mosquito innoculates a healthy individual with the sporozoites of the disease in its saliva.

The scales and spines that cover many parts of the body of the mosquito are varied in shape and color. They give to each species its color pattern and aid the scientist in identifying a given insect. Our model of *Aedes vexans* is dressed with over 20,000 scales, all punched out of .005-inch-thick cellulose acetate sheets with steel punches made for the purpose in 10 different shapes and 15 different color shades. A good part of the 1000 hours spent in making this model was consumed in punching scales and applying them one by one with adhesive. But most people are probably more interested in the piercing organ, which I have attempted to depict in these drawings.

▼ A MOSQUITO 2½ FEET LONG: the model constructed by the author to show in marvelous detail some of the things never seen by the unaided eye. *(Aedes vexans)*



The Screen

THE visitor taking lunch in the American Museum's Cafeteria may well have heard a group of scientists from the staff of the Museum discussing a current motion picture at the next table. What he took to be authentic scenes in a film purporting to be educational, the visitor now learns were false and inaccurate. These experts are the men whose scientific and artistic talents created the habitat groups of the Museum—the men whose knowledge of the world and its life has ensured their renowned accuracy.

Readers of NATURAL HISTORY not infrequently write in to inquire about the dependability of a current book or motion picture. This public concern in the authenticity of educational entertainment has given rise to these monthly film reviews.

"Water Birds"

WALT DISNEY'S new film, "Water Birds," is a worthy addition to the growing series of Walt Disney nature films. "The photography is superb and the synchronization of music and bird action is done quite entertainingly," comments Mr. Wayne M. Faunce, who is in charge of the American Museum's films and publications. "The 'Water Birds' should have great appeal to nature lovers and to those movie fans who simply enjoy outstanding films, of which there are all too few these days."

"In their form, colors, and behavior, birds that live near or in the water display wide variety," observes the well-known ornithologist James P. Chapin. "Many of them are large, and these have long been favorites with bird photographers. The most striking shots from the finest color films of a number of leading American experts are the materials used for the production of Walt Disney's 'Water Birds'."

We have also sought the expert opinion of Dr. Robert Cushman Murphy, Chairman of the Department of Birds at the American Museum. He comments that "The film has several minor shortcomings that do not detract from its general impact. Two species of terns are mingled in one family sequence, without the distinction that should be made. The narrator is in error with reference to the immobility of the black skimmer's lower jaw and the function of the tip of the spoonbill's beak. Furthermore, it is regrettable that some of the birds depicted, including the piping plover, one or more kinds of cormorants, the Laysan albatross, the white ibis, and the American stork that is known as the 'wood ibis,' are not identified by name."

Mr. Faunce found the frequent shift of picture speed back and forth from slow motion to natural speed to fast motion, done chiefly for dramatic effect, somewhat disconcerting, and the musical score toward the end decidedly overdone. He thinks the public would learn more about birds if fewer species had been included.

"A foremost aim in our branch of education," writes Dr. Murphy, "is to instill a love of nature that will redound to its appreciation and protection. There is no better way to accomplish this than by taking advantage of aesthetic opportunities. This Walt Disney has done supremely well in this film. The product is even more important because of its emotional effect upon the observer than because of what it teaches in the field of ornithology. It is primarily a work of art, notable for its design, color, balance, and climactic rhythm, and altogether worthy of the musical score with which it has been skillfully blended.

"Countless men, women, and children are likely to receive from 'Water Birds' the first, or the greatest, internal stirring that ever has come to them from the world of nature unspoiled, untouched by man's heavy hand. The film and its haunting memories will influence a large proportion of them to inquire more deeply and widely regarding wonders of which they had previously had little comprehension. Such an influence, working in an exalted emotional plane, might well accomplish more for the conservation of natural resources than any amount of didactic appeal."

"Water Birds" is being shown currently with "Robin Hood." It is distributed by RKO Radio Pictures and runs for about a half hour.

"Latuko"

"LATUKO," produced by Edgar M. Queeny for the American Museum of Natural History, was photographed on location in the African equatorial Sudan. A full-length feature film, it presents the pattern of life of an African tribe, the Latuko. This film has been banned in New York State because the natives appear in the picture as they are in the habit of doing in life—without clothes. A New Jersey Superior Court,

Authentic comments on films in the field of nature, geography, and exploration

Edited by Elizabeth Downes

on the other hand, ruled in favor of the film when an attempt was made to stop the showing of the film there. The judge commented that ". . . there is nothing suggestive, obscene, indecent, malicious or immoral in the showing of the Latuko aborigines in their normal living state. While it is true that the men have been photographed naked and the women naked above the waist, the exposure of their bodies is not indecent; it is simply their normal way of living. They are not shown in any attitude or function to which exception might justifiably be taken. In my opinion, only a narrow or unhealthy mind could find any depravity in the film."

Dr. James P. Chapin, an authority on Africa, who has lived there for over eight years and is a member of the American Museum's Department of Ornithology, comments:

"After seeing this excellent film projected several times, I am still charmed by it. It arouses so many memories of 40 years ago, when with Herbert Lang I spent some 25 months in the country of the Logo, a tribe of people rather like the Latuko and living only a couple of hundred miles farther west.

"It is always well for us to realize how many different ways of life are possible for human beings under the varied physical conditions that prevail on our globe, and usually we are forced to admire men and women who have found ways to succeed under most difficult climatic conditions. A short stay among a nude and primitive tribe in Central Africa is enough to cure anyone of the idea that nudity is "indecent." One quickly learns that these peoples possess a natural politeness that makes it quite outrageous to show any surprise at their lack of clothing. Probably they are better off without it, in such a hot country. On returning to some larger colonial settlement, where all the natives are clothed, one finds the people there not one whit more respectable for all their coverings.

"The hunting scenes in 'Latuko' may seem to some to be brutal. But most of us must confess to a feeling of satisfaction over a juicy beefsteak. We eat far more meat than do the Latuko, and they work harder for theirs. Their domestic herds increase much too slowly to supply all their dietary needs, and only in the animal season of drought are they able to carry out really successful hunts. So long as their supply of wild meat is not depleted, they are doing things the right way.

"'Latuko' seems to me so true a picture of life in the southern Sudan that I regret it cannot be exhibited much more widely; it has enormous educational value. The future status of the Anglo-Egyptian Sudan may come up for debate almost any day in the United Nations. Ought we not to be acquainted with some of the more remote inhabitants of that vast area, in order to understand what form of government will best assure their well-being?"

Because "Latuko" is produced under the auspices of the American Museum of Natural History, we have sought outside opinion. Dr. Joseph A. Greenberg of Columbia University's Department of Anthropology comments as follows:

"Since what I have to say about 'Latuko' will be so largely critical, I should like to first make clear that the film has some very real virtues, particularly the excellence of its color photography and the sustained excitement of certain episodes, especially the unforgettable hunting scenes.

"In my opinion, the sound commen-

PREVIOUSLY REVIEWED	WHAT THE EXPERTS SAID
Danger Under the Sea Modern version of Jules Vernes' dreams	Beneath the Mediterranean. Divers visit submarines. Limited marine life. Fine photography
Ivory Hunter One man's struggle to build an African Wildlife Park	Authentic geographically. Marvelous shots of big game. Good conservation
The Navajo Story of an Indian child facing today's problems	Superb documentary film. Photographed wholly in deserts and canyons of Navajo reservation in Arizona
Rhythm on the Reef Deep sea diving around Cape Verde Islands	200 feet down. Good photographic record. Sea life remarkably abundant
Strange World Amazonian adventure tale	Beautiful but grotesquely inaccurate. Lurid plot
Tembo African safari of Howard Hill with bow and arrow	Shear bravado. Geography confused. Scarcely an instance where native or animal life is shown normally

tary marks a backward step, as compared with some other recent films. From the first, when the people are described vaguely and portentously as an unknown people of equatorial Africa of a mysterious past, the cliches follow in an unending torrent in which 'mysterious' easily leads the procession. In spite of their unknown past, it soon appears that many of their customs are known to have existed in unchanged form 'since time immemorial.' The whole tone of the commentary, combined with a tendency to emphasize the most markedly aggressive side of Latuko behavior (and there *are* other aspects) cannot help but perpetuate the popular and erroneous stereotype of a violent, mysterious Africa still living in a dim and unchanging past.

"I believe that an exciting film, capable of holding the interest of an audience, could have been made from the present excellent cinematic raw material without recourse to outmoded cliches. On the other hand, 'Latuko' attains a natural unity often lacking in ethnological films by concentrating on the inherent drama of the seasonal round of life with its periods of rejoicing and anxiety."

LETTERS

Continued from page 290

Saturniid moth. This moth ranges from Canada to Florida, westward and south into Texas, New Mexico, Colorado, and Mexico. The adults have a wingspread of two to three inches. The fore wing of the male is yellow, that of the female brown. Both sexes have a large eyespot, or ocellus, on the hind wing. The spiny larvae of this moth are well known for their stinging qualities and should be handled very carefully. The full-grown larva has stout spinulated spines arising in whorls from small conical tubercles, arranged in seven rows on the thoracic and five rows on the abdominal segments. There are about a dozen spinules to each tubercle and the former are very sharp and often end in a stiff hair. These are the things that break off and cause irritation.

Boussingault

SIRS:

I am deeply grateful to you for your splendid magazine, the more so as I often read valuable articles concerning Peru, giving real facts without exaggeration. . .

One of the most brilliant contributions having to do with Peru and South America is Mr. Victor W. von Hagen's article about Boussingault. . .

RICARDO TELLO DEVOTTO
Huancayo, Peru

SIRS:

In the very excellent article "Boussingault—Scientific Adventurer," I would like to take exception to the statement that his chemistry papers gather dust and that no one now remembers the name of Boussingault unless he is a student of the history of science. As H. H. Mitchell and I recently pointed out in a review on proteins, Boussingault drew attention to the fact that "the alimentary virtues of plants reside above all in the nitrogenous substances, and consequently their nutritive potency is proportional to the quantity of nitrogen entering into their composition." This statement from Boussingault is as valid now as it was when he made it in 1851.

R. J. BLOCK, *Director*
Special Products Division
Biochemical Research Laboratory
The Borden Company,
Yonkers, N. Y.

Aged Eel

SIRS:

In your article "How Long Do They Live?" (March issue), Dr. Osmond P. Breland states that the oldest known eel reached 55 years. The world's oldest eel lived to be not less than about 88 years. It was captured in 1863 and kept in different aquariums in the town of Hälsingborg, South Sweden, until 1948. Allowing the normal three years for migration from the breeding area in the Sargasso Sea, it would have been 88 years old when it died. During its last ten years, the fish was kept in the Hälsingborg Museum, from which vouchers may be obtained. . .

BENGT SJOGREN
Trästa, Häverö, Sweden

The Screen

SIRS:

Each month I get NATURAL HISTORY on subscription through the Corning Glass Works for my office waiting room in our Company Hospital. The reading material is so popular that I find the patients seek your Magazine in preference to the others.

In your newly created department "The Screen," I read about the films "Danger Under the Sea" and "Rhythm on the Reef." These films must be very interesting . . . Is it possible to rent them for use by scout groups and the like?

HOWARD E. DECAMP, D.D.S.
Corning, N. Y.

We are informed that the films mentioned above are not available for rental. They are being distributed only through the regular theaters.—ED.

SIRS:

Your feature entitled "The Screen" is very interesting. . . .

J. A. BELLEAR
Boston, Mass.

Steiner photo

Red fox peering out of its den in Switzerland

SIRS:

I should like to add a word of appreciation concerning the fine periodical you publish monthly. You are doing a wonderful job in presenting articles of lasting interest in a layman's language.

DAVID J. ROGERS

Allegheny College,
Meadville, Pa.

SIRS:

The two issues of NATURAL HISTORY that arrived . . . were read from cover to cover the evening I received them. They are of such extensive interest, yet so uncluttered with extraneous material, that they are a joy, and I hope I shall never be without this magazine.

MRS. WILLIS C. KURTZ

Greenfield, Mass.

Nighttime Migration of Birds

The Louisiana State University Museum of Zoology has announced plans for a second co-operative investigation of the nighttime migration of birds, to be held this autumn. Volunteers all over the country are asked to help obtain telescopic counts of migrants passing before the disc of the moon. By the use of this method, which yielded surprising results in the spring of 1948, it will be possible to map the volume and flow of fall migration in different localities and to obtain answers to many puzzling questions.

The observation procedure is a simple one. Anyone who has access to a telescope, large or small, can participate. Interested persons are urged to write at once to Robert J. Newman at the Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana.

New Hope for the Bald Eagle

A new regulation on Bald Eagles in Alaska, recommended by the U. S. Fish and Wildlife Service and put into effect by Secretary of Interior Oscar L. Chapman pursuant to his authority under the Alaska Game Law, should have the effect of nullifying the $2 bounty imposed by the Territorial Legislature and lessen the existing threat to the bird's existence. The new regulation reads as follows:

"*Bald Eagles.* No open Season. These birds may be killed only when committing damage to fishes, other wildlife, domestic birds and animals. No carcass or any part thereof including feathers of birds so taken may be possessed or transported for any purpose."

It is hoped that the bounty law will now be actually repealed. Under it, premiums have been paid on more than 100,000 birds since 1917.

RICHARD H. POUGH
Curator, Department of Conservation

Expedition into Yucatan

An expedition into remote sections of the Yucatán Peninsula for the purpose of gathering a comprehensive collection of the insect life of the region and photographing other interesting aspects of the natural history of Mexico's southeasternmost state departed early in July under the joint sponsorship of the American Museum and the C. R. Vose Exploration Fund of the Explorers Club.

John C. Pallister, Research Associate in the Museum's Department of Insects and Spiders, and Mrs. Pallister have made their headquarters at Merida and have traveled from town to town by railroad, plane, native conveyance, and on foot in their search for butterflies, beetles, and other insects. Mr. Pallister is especially interested in leaf-eating beetles and in the papilio and morpho butterflies, two of the most beautiful in the world.

In addition, Mr. Pallister intends to make a photographic study of some of the unfamiliar aspects of Yucatán's civilization. He and his wife expect to return to New York in mid-September.

Family of hamsters in their burrow in Germany

Fisher photo

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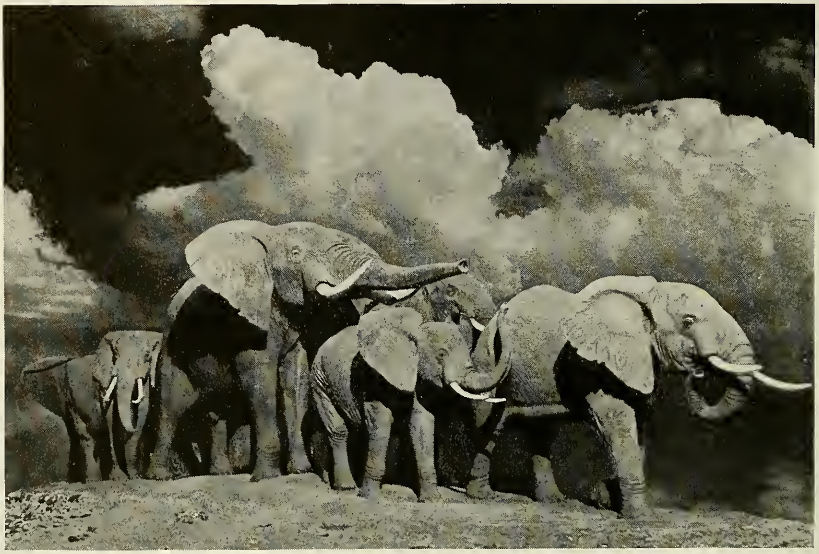

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NEW YORK 24, NEW YORK

Continued from page 321

"they" this time being a syndicate of Bogotá gentlemen "who were convinced that there was in the lagoon of Guatavita very great Golden riches." But they were soon unconvinced. The idea was right, but they lacked the tool. Within another 50 years, it was tried again, for in 1677 a group was formed "to better serve God and His Majesty to obtain him his royal fifth," and again an effort was made to wrest the golden treasure from its watery treasure house in Lake Guatavita. Once more, just enough gold was recovered to confirm, without satisfying, the theory. The operation defied their simple engineering, and they were rewarded with—failure. Throughout that century, as told in time-worn documents still extant in the National Archives of Colombia, there were repeated efforts and repeated failures to recover the gold of El Dorado.

The eighteenth century, that age of reason, brought some surcease to the search, and it might well have ended there except that the idea was given new impetus by Alexander von Humboldt. He had arrived in Bogotá in 1801, climbing up the Andes with his scientific companion, the *citoyen* Aimé Bonpland, so as to continue his explorations of South America. It was inevitable that he should be guided to the lagoon of Guatavita, for the legends of El Dorado had been part of the substance of his boyhood dreams. Humboldt made a sketch of the lake—the first. It is not fully accurate, for it has the romantic overtones of the century, but it did serve to illustrate his point.

Humboldt was convinced of the treasure to be found there. He made, in fact, an estimate of it. If 1000 Indians had made an annual pilgrimage to the lagoon over a period of a century, and each, as it was said, had thrown 5 golden trinkets into it as tribute to the Sun God of the deep, then there were well over 50 million golden images lodged in the funnel-shaped bottom of Guatavita. Thus he calculated that $300,000,000 in gold lay in this aqueous El Dorado.

In Europe he was disputed by only one person. Everyone else accepted his estimate. Only M. de la Kier of the Royal Institute of Paris rejected his modest conclusion. He calculated (as gold then went in 1805 on the Paris bourse) that there was $5,600,000,000 in gold at the bottom of the lagoon!

The effect of this speculation threw the Colombians into a frenzy. Now every lake in Chibchadom that had been known to have been part of the ceremonies was assaulted. These lakes — Suesca, Siecha, Ubague, Chingasa, Teusaca, Churuguaco Fuquene, and, of course, Guatavita — were the scene of fevered activity. One speculator decided to drain his lake by sending through a 400-foot tunnel, but it collapsed, killing his workers. Others tried to empty their lakes by means of a bucket brigade. Then, toward the end of the new fever, someone found a large golden ornament eight inches in diameter that depicted something no other white man had ever seen—a Golden Zipa being rowed out into the lagoon with seven Indian paddlers. This piece exactly portrayed the ceremony out of which El Dorado had been born. However, they still lacked the techniques to drain the lagoons.

Then, in 1912, as if to celebrate the fifth century of attempts to find El Dorado, an English company, styling themselves Contractors Ltd., arrived in Colombia with a capital of £30,000 to undertake the operation. The engineers added the modern touch to the long line of

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conquistadors. Away with Gordian cuts or impractical tunnels! They were going to pump the water out of the lake! Labor was recruited to drag the huge wood-burning pumps across the plains of Sesquile. They then urged them up the steep incline that leads to the lake. These were practical gold-hunters, engineers who knew their business. The pumps set up were soon siphoning the water out of the lagoon, so that within weeks the water was reduced to a mere pond, 40 feet below what was once the high-water level. Around lay the thick, black, noisome mud, which, shaped like a funnel, had precipated the heavier gold to the bottom.

Eureka! The modern pump had defeated the Zipa and his aqueous kingdom of gold. The workers, starting at the shore line under the heat of an unusually dry season, began to shovel out the gold-filled muck. Then a complication. Exposed to the sun, the mud turned as hard as cement. They now could no longer shovel. Away flew the golden aspirations; the gold was there—that had been proved, but it was the wrong technique.

The accounts showed that, whereas they had found $10,000 worth of golden trinkets, they had spent $160,000 in finding them. More capital was raised; but before anyone could again proceed, the bugles of The First World War sounded and the operations were deserted. The pumps were abandoned at the edge; the lagoon again filled up, and the Gilded Man returned to his sanctuary.

So up until now, no one yet has succeeded in breaking the resistance of the vanished gods of the Chibchas.

THE CASE OF THE MYSTERIOUS HAND ANIMALS

Continued from page 301

lution? Was it the ancestor of man, the dinosaurs, or the birds?

Man can be eliminated rather quickly and decisively, Dr. Peabody says. It is true that the footprints made by these beasts resemble a human handprint in wet mud, but the animals that made them were definitely reptiles. Man didn't appear on earth until many tens of millions of years later and could hardly be termed a relative.

Was the *Chirotherium* the grandfather of the dinosaurs? We don't know too much about the roots of the dinosaurs' family tree, but that suggestion offers a more fruitful possibility. In all probability the dinosaurs didn't develop from *Chirotherium rex* or any of the other large species. These were "end forms," and when they died out, the species became extinct. A better guess is that the dinosaurs may have developed from some smaller species of *Chirotherium.*

Was the "hand animal" the ancestor of all the winged creatures on earth? At first glance this seems like quite a far-fetched theory. But birds, Dr. Peabody points out, are known to have descended from very primitive dinosaurs. The *Chirotherium* used its outer toe as a prop, and this may have been the first step toward getting ancient reptiles to walk on their toes. Such a prop could also have led to the running foot, characteristic of the earliest birds and the ostrich today. Some scientists believe that the first flying creatures—half bird, half reptile—had to run along the ground to gain enough momentum for a takeoff. This would have been possible only with a running foot.

So, while Dr. Peabody's new trackways technique has given science a more accurate picture of the "hand animals," the mystery is not entirely solved, and it won't be until someone digs up a skeleton.

"Sam Welles of the University of California has what he thinks is a toe bone of *Chirotherium,*" Dr. Peabody says rather wistfully, "but we're not so sure. We've got our fingers crossed—hoping that somebody will dig up a whole skeleton some day, or even a part of a skeleton. Then we'd be sure of a lot of things we're guessing about now."

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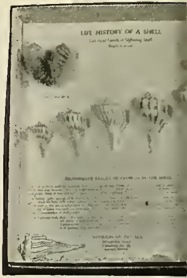
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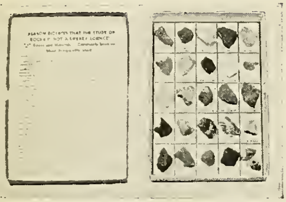

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AMNH photo

▲ Spotted Hyena shown in his natural habitat in one of the celebrated exhibits in Akeley African Hall at the American Museum

LETTERS

Hyena—him or her

Sirs:

The following statements appeared recently in one of the outdoor magazines. I find it difficult to accept some of them.

"Anything a hyena does is funny to a native. Great humor is found in the fact that Fisi fatally shot will eat himself before he is dead. He will snap and snarl at his own festooned intestines, or chew greedily on his own feet.

"Many African tribes have such an overweening fear of the spirits which attend death that they will not live in a hut or kraal in which death has occurred. . . . So practical prudence, in past, asserted itself, and when an aged and dying member of the family appeared to be on his last legs, he was lifted from his couch of pain and taken into the bush. He was left there, alive, to be attended by Fisi. The hyena became a walking symbol of the cemetery in the native mind. Many a mortally ill native was eaten alive by hyenas well before natural death came to claim him. Not a small percentage had the animal rip a savage chop from his face, and was cured, except for the terrible wound, of whatever illness beset him—cured by fright alone.

"The final joke is that the hyena is hermaphroditic—a blend of both sexes with the secondary manifestations of both. Carr Hartley, a wild animal collector, once penned together two female hyenas that could not possibly have been pregnant at the time. He turned them loose together. Both delivered a litter of pups."

I always read the "Letters" section in my Natural History, and wonder whether your readers might not find interest in a discussion of these statements.

John O. Orear

Kansas City, Mo.

The following comments are offered by George G. Goodwin of the American Museum's Department of Mammals:

Many strange and fearful stories about the Spotted Hyena have come out of Africa, and native superstition is rampant with incredible beliefs about the animal. Strangely enough, however, there is enough truth in this fantastic folklore to trace its origin.

Scarcely a night passes on the African veld when a traveler will not hear the strange cry of the prowling bone crusher. Its voice is extraordinary, and the sounds it produces are legion. The hideous laughing cackle uttered when the animal is approaching a carcass is the weirdest of them all. To mystify the traveler further, the hyena is a ventriloquist, and the sounds offer little clue as to its exact whereabouts.

Probably one of the most horrible sights I ever witnessed was when I happened to come out of the brush just as a hunter shot a hyena. The bullet struck it in the abdomen and ripped it open. The hyena is noted for its extraordinary vitality. This animal, though mortally wounded, continued to gallop away and, without stopping, reached back and snapped off the protruding intestines, which only dragged out more. The horrifying spectacle of this awful performance was repeated time and again. The animal never paused in its headlong rush, even though two more bullets entered its side. Finally a fourth in the shoulder put the animal out of its misery.

There is nothing unusual in the fact that a hyena will chew its foot off when caught in a trap; most animals will, and it is easily explained. The pressure from the jaws of the trap cuts off circulation, and the paw soon becomes numb. The animal is insensible to the fact that it is biting its foot off in the effort to escape.

There are no records of the Spotted Hyena attacking a native during the day or a white man at any time. On hot nights natives often sleep out in the open, and there are many cases of their having been attacked by hyenas. The animal usually goes for the face, and one sees natives that have been frightfully scarred in this manner. It is a common practice in many parts of Asia and Africa for natives to move aged people about to die out of their huts and villages for superstitious reasons and leave them in the open to die. One does not like to contemplate the role of the hyena in such a situation.

Another peculiarity about the spotted hyena is that the female exceeds the male in size and that the sexual organs of the female are quite peculiar in structure and closely resemble those of the male in external appearance. This condition is found only in the Spotted Hyena, *Hyaena crocuta*, and is unique among the carnivorous animals. It has given rise to the native superstition that the hyena is a hermaphrodite, able to assume the role of male or female at will. Many white people have been fooled by this marked similarity of the sexes.

The peculiarities of the hyena do not end here. Its gait is noteworthy, for it is one of the few animals that paces. The fore and hind limbs on each side of the body move forward together, producing a rolling gait much like that of a camel.

Though most hunters consider the hyena one of the most degraded of animals, it is surprisingly free from body odors. It smells much sweeter than a lion or a jackal. In fact, the natives readily eat the meat of the Striped Hyena and are keen to get the heart, believing that it will bring them courage. This is rather strange, as the hyena rarely puts up a fight when cornered or wounded and is generally referred to as a coward.

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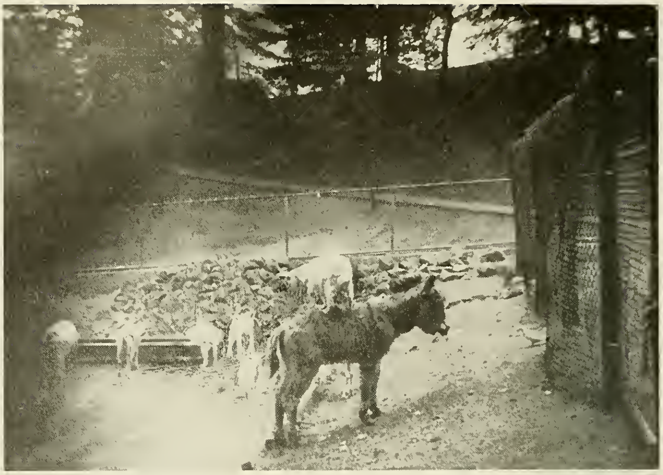

Kidding Kid

Sirs:

I snapped the accompanying photograph at the zoo in Druid Hill Park in Baltimore. I am wondering whether this is a very unusual situation or whether perhaps the goat has some animal-sense agreement to dance about on the larger animal's back, posssibly to relieve the irritation of insect bites, etc. . .

Merle V. Martin

Baltimore, Md.

The following comments come from George G. Goodwin of the American Museum's Department of Mammals:

This charming picture of domestic bliss is just about what would be expected under the circumstances. Goats, especially kids, are perhaps the most playful of the ungulates, or hoofed animals and they love to show off their ability to leap and maintain a footing in precarious places.

Needless to say, it is not a common practice for goats to ride on a donkey's back, but where both animals are kept in the same enclosure and become trusting friends, such a procedure is almost inevitable, especially if the donkey's back is the highest point available.

The goat has no intent to render any service to the donkey, such as scratching his back. It is purely a case of frolicking. Kids often try to outdo one another, and they sometimes stage sham battles and put up a good show, then scamper away good-naturedly.

I used to keep goats when a boy, and it was not unusual for one of the kids to leap playfully onto my back when I was bending over, then climb up onto my shoulders when I stood straight up.

★ ★ ★

Sirs:

We wish to express our heartiest congratulations and our sincere appreciation for the printing of such a splendid article as "Who is Choking Yellowstone's Geysers," by George D. Marler. What it tells is true, and the facts have been a source of deepest concern and distress to us. Last fall we wrote to several senators and representatives about this problem, and even to the National Wildlife Federation. We received some fine answers, but as yet we have heard of no solution to the problem.

It is heartening, therefore, to see your Magazine taking some initiative in bringing this deplorable situation into focus before the American public. . .

Mr. and Mrs. Norman Mertens

Pasadena, Calif.

Sirs:

. . . Natural History Magazine is one of the most wonderful, enjoyable, and valuable publications issued. The good it does toward encouraging the preservation of our heritage is incalculable. It is first on my reading list, and I never pass an opportunity to call the attention of others to its advantages and pleasures. Those who contribute to it and work on it merit the appreciation of all.

George W. Paxson

Monroe, Mich.

Sirs:

May I say what a wonderful publication I think Natural History is. I am indebted to it for many enjoyable hours of fascinating reading. It is so educational in such an entertaining way. When I have finished with my copy, I pass it on to a friend, who also enjoys it very much. . . One suggestion: I would like more maps, especially small ones showing the location of the place under discussion, such as you included in the article on Lassen Volcanic National Park. . .

Aileen Mitchell

Houston, Texas

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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VOLUME LXI—No. 8
OCTOBER, 1952

Chipmunk ....Cover Design
From a color photograph by Richard Hooke

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The nettle strikes with a venomous weapon you can't see, and its poisonous effects may last for days

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Good Fences Are Good Neighbors....William A. Breyfogle 379
And a sort of city of refuge for living things not tolerated elsewhere

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Authentic comments on films in the field of nature, geography and exploration

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THE COVER THIS MONTH

Of all the wild things that liven the American countryside, few are as colorful as the little striped chipmunk. Its alert brisk manner and gay chuckling call add a decidedly cheerful note to the sunlit woods. Being a lover of warmth and comfort, it is most active during summer. Now, in October, when the leaves are turning to red and gold, the chipmunk becomes drowsy, and during the cold winter months it will be fast asleep in a snug warm nest below frost line.

By the middle of March in northern latitudes the chipmunk will be out on warm pleasant days. Females produce a litter of from three to five young, which are naked, blind, and helpless, though the stripes are discernible from the first.

During the harvest season this sociable little ground squirrel is busy gathering seeds, nuts, and other edible foods. Using its bulging cheek pouches for transportation, it gathers as much as eight quarts in one storage chamber for use during mild weather in winter.

George G. Goodwin

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HAMMOND'S NATURE ATLAS OF AMERICA

- - - - - - - - - - - by E. L. Jordan

C. S. Hammond and Co., Maplewood, N. J. and New York, N. Y., $10.00, 256 pp., 320 original paintings

THE author, his collaborators, and Hammond's are to be commended for initiating this comparatively new approach to popularization of natural history. The atlas type of presentation naturally goes well with the immense degree of telescoping and condensation required to cover ever so briefly this enormous field. The work naturally leans heavily on its colored illustrations, some of which, whether due to original deficiency or to faulty reproduction I know not, are distinctly disappointing. There is a certain fuzziness, which may be due to defective registration, in some of the illustrations. Some of Mr. Cody's delineations of butterflies in positions of flight are not very convincing; the Monarch and the Banded Purple appear in rather tortured positions. For the numerous maps showing distribution I have no criticism, save that the color yellow, especially in artificial light, is a very weak medium for showing scattered dotted areas of dispersal. Also little is gained by showing a series of concentric color lines parallel with the coast for organisms having continental-wide distributions.

Dr. Jordan, being a Rutgers man himself, naturally chose most of his collaborators from that university. The articles on the species or genera selected as examples, though of necessity greatly condensed, are very good, but would have been made more valuable by inclusion of short reference lists. One wonders why the marsupial opossum is placed between the rabbits and the ungulates; and why, if the mustang and the house mouse are given space, the domestic dog and cat, both of which are introduced and become feral, have been omitted. The emphasis placed on conservation both in the text and by means of the special list of National Parks, National Forests, and Game Refuges is one of the outstanding features of the book.

I like especially the sections dealing with "Climate and Vegetation" and "Land Forms and Nature." The introductory part, "Where to see American Nature Best" (pp. 6-29), constitutes a "Baedekker" for the whole of nature in the United States and Canada. There is a glossary and an index.

G. H. H. TATE

PRELUDE TO HISTORY

- - - - - - - - - - by Adrian Coates

Philosophical Library, $4.75, 289 pp., 5 maps, 28 illusts.

DISCOVERIES relating to prehistoric man have been accumulating in our museums at a steadily increasing rate for more than a century, and technical reports on the same subject crowd our libraries. Our human ancestors are of more than ordinary current interest, and people from all walks of life—amateurs and professionals—have been repeatedly reviewing the available information during the past 40 years. As a result, a variety of more or less simplified introductory summaries have been produced, but many of them, though genuinely informative as far as they went, were unavoidably out of date before they came off the press.

The present contribution, while hardly more permanent, embodies several new features. It was written in England by a professed layman and is confined to the Old World's Paleolithic period. Besides giving the usual abbreviated descriptive and interpretative account of what is known, the author includes what may be called a digest of an additional body of literature pertaining to related fields of inquiry, such as geology, biology, psychology, and sociology. In short, the book strikes one as a creditable supplement to A. J. Toynbee's *A Study of History*.

Specifically, the treatise opens with a philosophical essay on "History and the Prehistorical," devotes seven partly illustrated chapters to such topics as environmental changes, human skeletal remains and their classification, successive stages of industrial and artistic developments, and concludes with supplemental essays on the primitive mind, primitive society, the passing of the hunting economy and paleolithic man, and his modern successors. Distribution maps, bibliographies, and indices are included.

Mr. Coates, relying on a wide range of information and, as he frankly admits, on a logical rather than a scientific point of

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view, writes with considerable assurance. He proposes some welcome simplifications of terminology and classification of data. He accepts the views of some authorities and boldly differs from others. His personal leanings seem to include the plural origin of humankind, even perhaps the inheritance of acquired physical characters, and also the diffusion of culture traits as opposed to independent inventions. He definitely looks upon biological evolution as independent of intellectual capacity and consequently credits cultural achievements to historical accidents rather than to inherited instincts. Naturally, therefore, he repudiates teleology or divine purpose as an element in human progress. As a final conclusion, he maintains that the origins of language, religion, and various other traits of human behavior are governed by inherited industrial and social traditions dating back to subhuman times and therefore beyond recovery.

The book deserves a more extended critical review and is to be recommended chiefly to those who already have some acquaintance with the subject.

N. C. Nelson

THE CREATION OF THE UNIVERSE

- - - - - - - - by George Gamow

Viking Press, $3.75, 144 pp., 52 illusts.

ASTRONOMY includes much that is exact, such as the determination of planetary configurations, the time and circumstances of eclipses, and other matters of positional astronomy. It also includes much that is speculative, as in the branch called cosmogony, which attempts to explain the origin and evolution of the universe. While each is fascinating in its way, the student must recognize this difference if he would properly evaluate what he reads.

Dr. George Gamow's *Creation of the Universe* is a brilliant attempt to explain the complex story of cosmogony for the intelligent lay reader. He presents the subject in an attractive style similar to that used so successfully in his earlier books, *One, Two, Three—Infinity*, *The Birth and Death of the Sun*, and *Biography of the Earth.*

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In this work Dr. Gamow goes to the very root of the problem and discusses the origin of atoms from the primordial stuff that existed before matter had attained the state of differentiation it exhibits today. Although this material is clearly presented, the reader will find it easier to follow if he has at least a speaking acquaintance with the rudiments of nuclear physics.

Those who have read Fred Hoyle's *Nature of the Universe*, which was published about a year and a half ago, will find interest in Dr. Gamow's criticism of his theory of "continuous creation."

As in his previous books, Dr. Gamow's original, down-to-earth analogies, numerous diagrams, and clever line drawings are a combination that raise this book above the academic level and add just enough seasoning to make it attractive to anyone with intelligent curiosity about his environment.

The author has thoughtfully placed most of the mathematical material in the appendix, where it is easily available to those who desire it but will not embarrass the nontechnical reader.

Due to the nature of the subject, a few may find this volume a little harder to digest than some of Dr. Gamow's earlier contributions, although it is certainly a worthy addition to the list.

ROBERT R. COLES

UNDERSTANDING HEREDITY. AN INTRODUCTION TO GENETICS

- - - - by Richard B. Goldschmidt

John Wiley & Sons, $3.75
228 pp., 49 illusts.

THE progress of genetics in the last 50 years is one of the great achievements of modern biology. From a confused, uncertain collection of observations it has become a neat and elegant corpus of demonstrable principles, not only susceptible to exact mathematical expression but also available for reliable predictions.

The fundamental aspects of all this are clearly set forth in Professor Goldschmidt's *Understanding Heredity*. He explains the basic concepts of heredity, the mechanisms by which the genes that control heredity are governed, the structure and nature of chromosomes, linkage, mutation, and other similar genetic phenomena. The exposition is simple and easily apprehended even by the lay reader.

Although *Understanding Heredity* does not pretend to cover the entire field of genetics, there is enough in it to fascinate anyone seeking a good introduction to the subject.

HARRY L. SHAPIRO

GROWTH AND CULTURE: A PHOTOGRAPHIC STUDY OF BALINESE CHILDHOOD

- - - - - - - by Margaret Mead and
Frances Cooke Macgregor

G. P. Putnam's Sons, $7.50, 223 pp.,
58 plates

PERHAPS no human being in the world has ever been so child-conscious as the average American of today. Our children are fed, punished, instructed, and even entertained according to "the book." Yet it is not enough, as Dr. Mead asserts in the opening chapter of this most readable and appealing volume, merely to adopt uncritically the latest fashions in child-training practices currently endorsed by child psychologists. Like ourselves, most psychologists who concern themselves with our children are caught in the web of our own beliefs and customs. It is only by studying child-rearing practices and the development of children in other cultures that we may evaluate to what degree given behaviors are universal features of the human growth process, or that we may ascertain to what extent these behaviors may be modified by learning.

Specifically, Dr. Mead attempts to discover what consistencies can be found—in spite of wide individual differences among children—when Balinese children as a group are compared with American children of the New Haven area as studied by Dr. Arnold Gesell and his associates, formerly of the Yale Child Development Clinic.

The 58 excellent plates, analyzed and selected by Frances Macgregor, have been arranged in three sequences. The first illustrates the individualities of the eight Balinese children that form the core of the study, while the second shows the way in which most young Balinese develop progressively from sitting to walking. The final sequence depicts those forms of motor behavior in which Balinese

Continued on page 382

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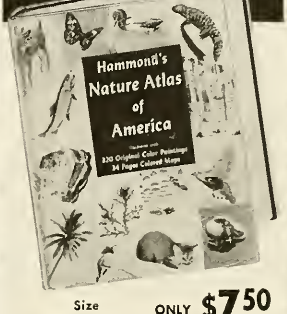

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a scientific Journey t

Part I

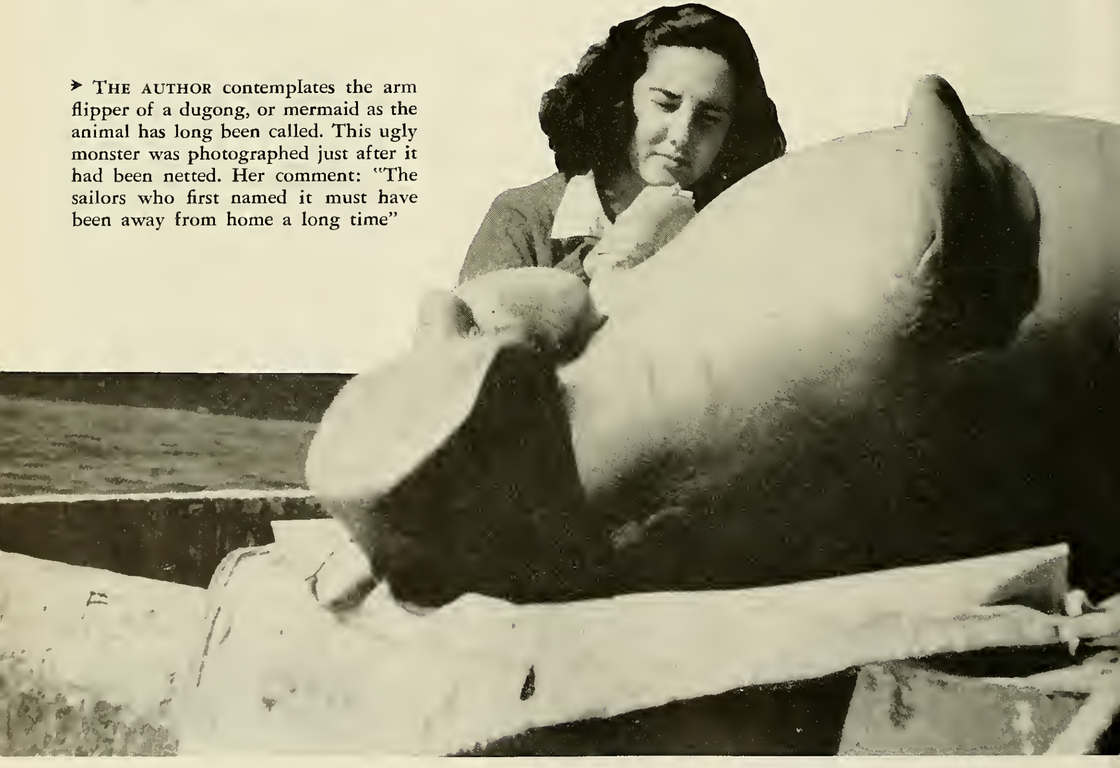
"SO that's the mermaid!" I exclaimed, as I gazed upon a creature standing eleven feet tall.

We had just opened the door of the little museum that is part of the charming Marine Biological Station at Ghardaqa on the Egyptian coast of the Red Sea. I had arrived the night before after a long desert trip from Cairo, and Dr. Gohar, the Director, was showing me around.

"Yes, that's it," he said. "People thought mermaids were extinct in the Red Sea until we started catching them in our nets." His blue eyes twinkled above the brown beard that hid the rest of his expression.

What we were looking at was a gigantic female dugong, sometimes called "sea cow" or "mermaid." Dr. Gohar preferred the latter name because he liked to fill his visitors' minds with a romantic and beautiful vision beforehand and then startle them when he finally displayed the unattractive monster. The face of this mammal had a peculiarly blank look. The tiny eyes, set far back on the sides of its head, could hardly be seen without close examination. The forearms resembled flippers, and under each was a large teat that seemed more than adequate for suckling its young. The smooth bulky body tapered toward the rear into a good-sized tail fin—more like the fluke of a whale. It lacked the long flowing hair one imagines a mermaid to possess. In fact, the head was bald, and the only noticeable hairs were in the form of bristly whiskers around the mouth.

If this strange creature gave rise to the mermaid legend, as Dr. Gohar thinks likely, the sailors who first saw it certainly must have been away from home a long time. But under certain conditions it must suggest a bit of femininity, for



➤ **THE AUTHOR** contemplates the arm flipper of a dugong, or mermaid as the animal has long been called. This ugly monster was photographed just after it had been netted. Her comment: "The sailors who first named it must have been away from home a long time" even its Arabic name, *arus el bahr,* means "bride of the sea."

"Mermaids," however, were only one of the hundreds of fascinating kinds of inhabitants of the Red Sea that I was to see and study in the coming year. It was the first year that the U. S. Government had arranged to send Fulbright Research Scholars to Egypt, and I was one of the lucky ones.

The Marine Biological Station at Ghardaqa is located at the extreme eastern edge of the Sahara, where the great stretches of barren desert come to an abrupt end and are met by the blue of the Red Sea. An office building, library, museum, engine house, and little cottages for visiting scientists and permanent staff families are spread over the desert, forming a little community of its own about four miles north of Ghardaqa. At Ghardaqa itself, the Shell Company operates an oil field which, although the oil supply is giving out now, still employs a number of the natives from this fishing village. Beyond the water's edge, the bottom drops past fringing coral reefs, teeming with marine life, into submarine valleys and mountains also topped with coral. The sea is one of amazingly high saltiness, high temperatures, and mountainous floor.

The part of the Marine Station that completely charms every visitor is situated at the end of a pier

A young woman describes her experiences as a Fulbright Scholar at the remote Marine Biological Station at Ghardaqa, Egypt—lonely rendezvous of sharks, mermaids, and native princes

The Red Sea

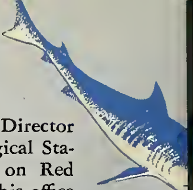
By Eugenie Clark

Photographs, Marine Biological Station, Ghardaqa

EGYPT
Ghardaqa
RED SEA
FRICA

➤ In the laboratory of the Marine Biological Station: the author and distinguished visitors looking at a variety of small coral fishes. They were captured by frightening the fish into a small piece of coral and then lifting the coral out of the water and shaking the fishes out into a net

➤ In long trips out to sea, Dr. Clark and native fishermen took a large sailboat *(background)* and then used small dugout canoes to work in among shallower reefs. This small canoe was usually kept handy when they were spear-fishing on outer reefs so that the party could jump in when large sharks came too close



◄ **Dr. Gohar Bey**, Director of the Marine Biological Station and an expert on Red Sea corals, shown in his office at the Station

▼ **The Director** of the St with the U. S. Ambassador to E and the author and other g on the pier leading out from museum *(left)* and offices *(r*

at the rim of the Red Sea basin. Here are compact little laboratories with many glass and stone aquaria for keeping live specimens for study. In one aquarium a little clown fish, hiding in a giant sea anemone, comes out to lure another fish into the paralyzing tentacles of its host, in which only the clown fish and a special black damselfish can snuggle safely.

In another aquarium, a group of sea anemones suddenly gets up and walks away, and you see that they are enjoying a commensal existence on the borrowed shell of a hermit crab. A group of pulsating heads of xeniid corals contract their short tentacles like a hundred arms reaching up, opening and closing the fingertips of their hands. A chicken fish, with its graceful orange and brown plumes spread like a peacock's tail, swims slowly. Only when you touch it can you feel the tips of the hidden, hollow, hypodermic spines of this venomous scorpion of the sea.

From under a piece of stone a goby looks at you; and on this stone crawls a beautiful, rosy-red mass of jelly with a ring of small white feathers on one end. If you pick it up and stroke the soft mass in your hands, it starts to open up like the wide circular skirt of a dancer. And if you put it back into the water—the skirt begins to dance! With graceful undulating movements, it glides through the water like the skirt of an invisible ballerina. Is it any wonder that the natives call this sea slug "Bedia," after Egypt's most famous dancer?

Sit down at a microscope and see the thousands of trochophore larvae twirling in little capsules taken from a pink ribbon rosette that Bedia laid on the side of her aquarium last week. But don't look up from your microscope and out the window or your attention will be drawn to a giant sawfish, an eleven-foot manta, a half dozen sharks, sting rays, guitarfish, and a hundred other fantastic marine animals living in the large outdoor pools beside the laboratories.

If you like swimming, dive off the end of the pier into the clear blue open sea, adjust your face mask, and in a few strokes find yourself in an infinite aquarium scintillating with strange and beautiful marine animals that peer at you from sanctuaries in a large coral garden.

Such was the atmosphere in which I worked!

In the mornings we usually took out sailboats and fished—by trawl, spear, poison, net, hook and line, and hand—sailing over, diving into, and wading across these coral gardens. The fascinating specimens we caught were then brought back to the laboratory. Some were kept alive so their behavior could be studied. Others were dissected so we could examine the details of some of their peculiar anatomical features. Some evenings I could hardly get through my dinner fast enough to go to the library and compare the day's catch with the specimens described by Ruppell and Klunzinger—the last ichthyological collectors in the Red Sea in over 70 years. Sometimes I would find I had collected dozens of examples of a fish so rare that it had previously been known and described from only one specimen.

➤ **Dr. Clark** standing on a shallow ledge of corals in Sharks Bay just after spearing a porcupine fish or spiny blowfish. The fish was deflated when speared through its balloon-like stomach

Or else I had found one that wasn't in the books at all, and I would realize excitedly that it might be a species as yet unknown to science.

But this was nothing exceptional, for the Red Sea is still virgin water for ichthyologists, and I was the first to study at this Marine Station, the only station of its kind on the Red Sea. Sometimes by reviewing a series of specimens, an unknown age, color, or sex variation of a particular species would be discovered. Tracking down the names of these colorful sea gems was as exciting as a detective search. Often, as the night grew late, only the thought of our early-morning sailboat trip to another coral reef, where we would spend hours diving strenuously, could force me to close the books in time for a decent night's sleep.

Living quarters at the Marine Station were more than comfortable. There were two cottages for visiting scientists, with space for twelve persons if necessary. But as there were seldom more than two or three scientists there at a time, I usually had a cottage all to myself.

My cottage bordered the edge of the desert, and the Red Sea lapped below it. At high tide I could just reach my quarters without getting my feet wet. From the back balcony I could see the sea—like an ocean on some days, like a still lake on others—with the mountains on the southern tip of the Sinai Peninsula in the clear distance. From the front veranda, desert plains and mountains composed the scenery.

Near by was a small pink and white striped building, the native mosque. From my window I saw the worshipers come down to the sea and wash themselves before going into the mosque to pray. And then I could hear the voice of the muezzin and the chanting of the passages from the Koran. Sometimes in the evening the children from near-by homes would beat out a characteristic rhythm on homemade drums. They sang and danced, and the exotic quarter-tone scale music of the Arabs came clearly across the desert from the flute of Soliman the Sailor—an incredibly sweet-toned instrument that consisted of merely eight holes drilled in a lead pipe.

A few weeks after I arrived, three "mermaids" were caught, tangled in our large shark nets. Unfortun-

➤ **Mohammed**, the versatile cook at the Marine Station, smoking his homemade pipe with a beer can built in to hold water. At right is his brother, Soliman the Sailor. Both men are expert fishermen. Their finely chiseled features suggest they are descendants of Arab tribes ately, all had died, but there was the job of making anatomical dissections and preparing the skeletons and skins. Dr. Gohar filled three quart bottles with their parasitic worms. As dugongs are herbivorous (they feed on eelgrass on the sea bottom), I was prepared to find a long intestine, but even so, I was amazed when 120 feet of "rubber hose" came out of an 8-foot female. The skin and skeleton were prepared and preserved by the Station's skilled taxidermist, Mr. Mohsen, and his three assistants.

Prince Ismail Hassan came for dinner that night. At a marine station he was naturally expecting fresh fish. When he tasted the delicious steaks that seemed like a mixture of veal and pork, he commented politely, "I didn't know you could obtain such fine meat out here."

"Oh, yes," gentle Dr. Gohar answered. "This is from a mermaid we caught today," and he continued eating like a serious cannibal.

During the following week, our versatile and excellent cook, Mohammed (who smoked a homemade hubble-bubble pipe with a beer can at the base to hold water), prepared dugong meat in every way imaginable—fried, boiled, broiled, baked, and in spaghetti sauce. Three dugongs, over half a ton of tasty meat, can go a long way.

We were munching on the last of the mermaid meat at lunch one day when the old *Reis*, the "Chief" among the sailors, came rushing to tell us that a giant devilfish had been caught alive. The internal anatomy of this animal is of much scientific interest, and we rushed out to see the valuable specimen.

I got my camera ready to record the lifting of the beast into the pool, and the Prince came in his new golf togs and white umbrella. We all watched with great interest as the sailors hoisted the manta from the sea. When it fell free into the pool, it splashed around ferociously. Its giant "wings," with a spread of over ten feet, pounded down on the water surface and churned up the mud and gravel till the whole pool became opaque. After a while it calmed down and swam about like a graceful, giant black bat. It became the main attraction among all the fishes on display and was like a pet. It soon learned the limits of its relatively small enclosure and swam about in regular patterns, banking the turns like a great transoceanic air liner. It was magnificent.

During my year at the Biological Station, we had a number of visitors. Some stayed only a few days, others weeks. There was an Egyptian student of algae and another algologist who was English, a party of bird scientists, the Rector of Farouk University, the Vice-Rector of Fouad University, two Egyptian princes, and the American Ambassador—to mention only a few who were attracted to the enchanting life among the coral reefs. The ex-King had a palatial resthouse near by but was said to use it infrequently.

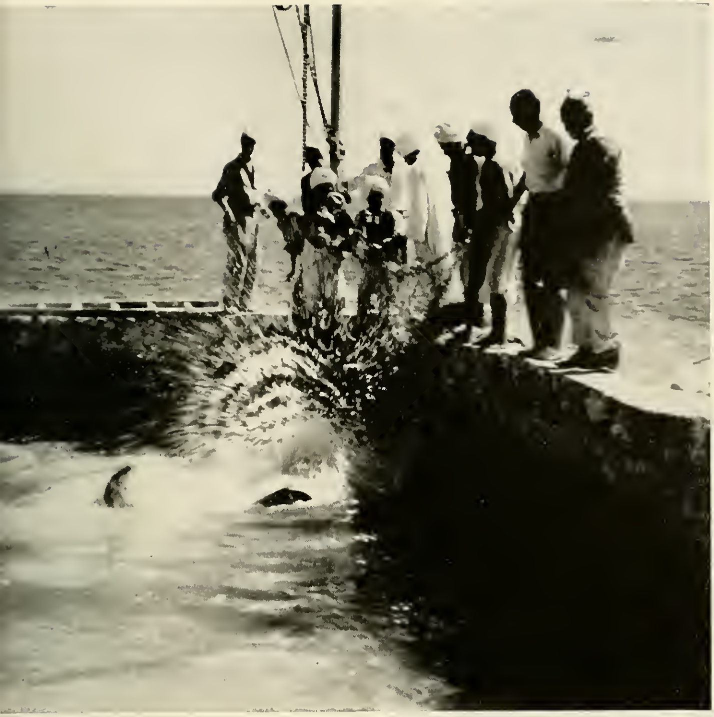
Of all the visitors, however, the most important for me was an M. D. from the States. On a month's leave between hospital appointments, Ilias, my husband, came to see for himself this wondrous life of fishing in the Red Sea, about which I had so enthusiastically written him for the past several months. On his first dive underwater into a coral garden, the shaft from his spear gun sank into a parrot fish, and he was sold on spear-fishing. He became the most ardent spear-fisherman I had ever seen. I had found someone who was still raring to go when I was ready to quit.

It was two weeks after his arrival that we had our first uncomfortable underwater experience. We were spear-fishing on the outer edge of a crescent-shaped reef not far from the Station. He was playing with a speckled sea bass, trying to spear it during the brief moment when it peered out of one of several holes in the coral. Gradually, Ilias was learning the pattern of the connecting branches to all the holes. He was careful not to bring his face or hands too close to these holes, because only a few days before when he did look closely into a reef hole, the head of a moray eel, with its open mouth and jagged teeth, looked back at him.

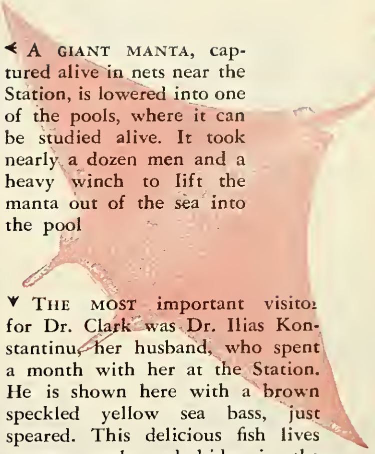
Finally he aimed his spear gun and shot into a hole, but while he reloaded it, the big eyes of the bass watched him from another. I watched the game in amusement, and then I spotted a rare butterfly fish and chased it around to the other side of a large group of corals.

The butterfly fish scurried down the slope of the reef and hid among some branched corals. I dived for it with my spear ready, but my aim was bad. I dived again and again, trying to locate its hiding spot. And then, for some unknown reason, I suddenly glanced behind me. Less than four yards away was an enormous fish. My first impression from its size was that it was a shark, but as I got a better look at its large silver form, lying motionless near the surface of the water, it was plain to see that this fish was a barracuda of gigantic proportions. It had turned its profile, and its whole length was visible. Its sharp eye was unmistakably watching me. How long it had been there, I don't know. I must have been safe, however, for if a barracuda intends to strike, I doubt that it thinks it over very long. I took no chances and started to back away slowly onto a shallow part of the reef. I decided it was best in a situation like this not to swim away quickly and create an image of flying arms and legs but to let the barracuda continue to see my body as a whole. After all, I was at least its equal in length.

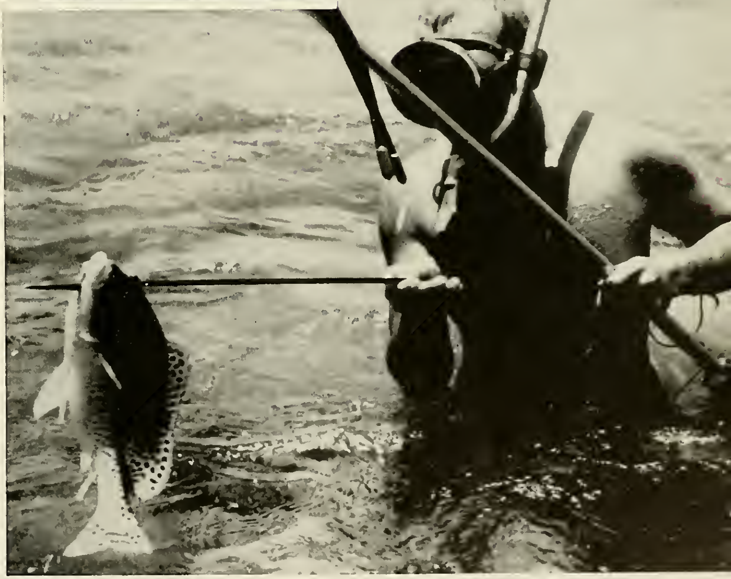
Then I remembered my last look at innocent Ilias on the other side of the group of corals—blissfully diving down among the reef holes trying to locate his fish, with his feet waving about and his sparkling new white sneakers looking, from a distance, like two little fishes—barracuda bait!



◂ A GIANT MANTA, captured alive in nets near the Station, is lowered into one of the pools, where it can be studied alive. It took nearly a dozen men and a heavy winch to lift the manta out of the sea into the pool



▾ THE MOST important visitor for Dr. Clark was Dr. Ilias Konstantinu, her husband, who spent a month with her at the Station. He is shown here with a brown speckled yellow sea bass, just speared. This delicious fish lives among corals and hides in the holes and crevices, where it can be speared by the quick spear-fisherman



I called out to him firmly, trying not to alarm him too much. "Ilias, come onto the reef immediately." He detected a very serious tone in my voice and answered, "Stay there, and I'll get the boat."

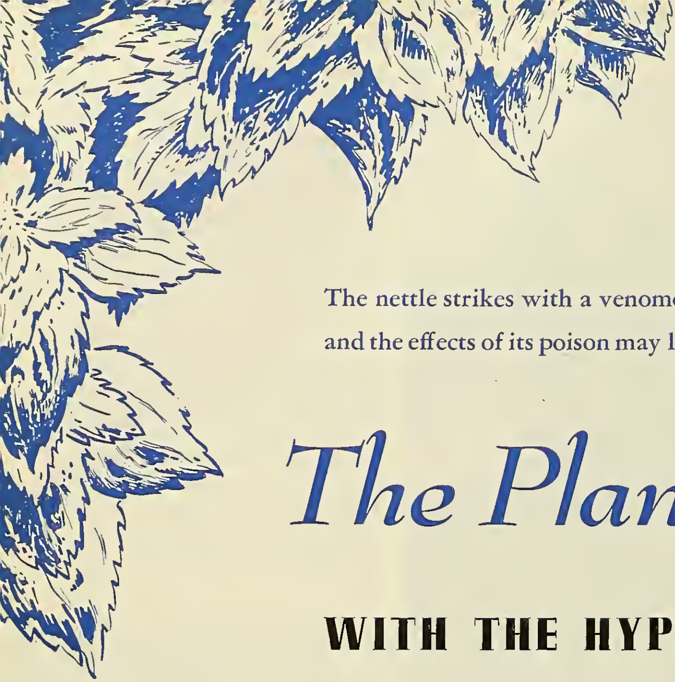
Before I could stop him, he swam out into the open water to our anchored rowboat. His arms churned bubbles in the water, and his white sneakers, going full speed, trailed behind as he headed into the barracuda's path.

But he made it. He rowed the boat over to where I was standing on a reef in just a few feet of water.

"It was a shark, wasn't it?" he said.

When I told him it was no dull-eyed shark but a large barracuda, he was not too impressed. For several days, however, I could not enjoy goggling under water. I had to look behind me every few seconds, and I always carried a vivid picture of that barracuda.

But have you ever seen your husband disappear under water with two sharks swimming around him? Perhaps then you can sympathize with my feelings during an experience at "Sharks Bay," which I'll have to tell you about in the next installment.



The nettle strikes with a venomous weapon you can't even see, and the effects of its poison may last for many days

The Plant WITH THE HYPODERMIC NEEDLE

By Jerry Laudermilk

WE were out to get a set of desperately needed photographs, and our goal lay about a dozen feet ahead of us—when my expedition struck an unexpected snag in my wife's ethical code. She plumped herself and her camera down beside the irrigation ditch and declared, "We are no better than a couple of ordinary trespassers and ought to be locked up."

This streak of diamond-hard integrity, which generally stays put in my wife's temperament, can completely derail a perfectly adjusted situation. I'm no good at photography myself and had to have the pictures. The emergency was desperate. But I thought fast and tried to make myself equal to the crisis. I assured her that the rancher on whose grove we had tracked down our subject owed me ten dollars and that what we were doing was perfectly proper, provided you didn't look too closely into the details.

So having squared myself with my wife's tribal customs and taboos, I took up our conversation where we had left it. My point was that in many cases plants have anticipated with precision certain mechanical contrivances that we generally accept as strictly human inventions. We are all familiar with barbed hooks and points. The principle of the awl—a hard point for punching holes—was developed by a very ancient plant, *Psilophyton princeps,* which lived as far back as the Devonian period, or roughly 300 million years ago. But the crowning example of Nature's elaboration upon a simple, basic theme—here, the awl theme—was to be found in the mechanism of the microscopic hairs of the very weed we were seeking to photograph.

In this case we have a forecast of a human invention that didn't actually materialize until the year 1853, when the French physician Dr. Charles Gabriel Pravaz described the first hypodermic needle. With the approbation of Dr. Alexander Wood of Edinburgh, this novel instrument was at once appropriated by the medical profession as a brand new discovery, but the basic patent had been in operation for millions of years.

We are mildly surprised when we recognize the principle of the hypodermic syringe in the poison fangs of snakes or the stings of insects. But we can surely call it fantastic when we see it perfectly developed in the stinging hairs of a plant, the nettle. And here it was.

It had the three essential parts of the hypodermic needle. First, there was the needle itself—the long, hollow hair shaft with its ball-shaped tip, about which I'll have more to say presently. The needle is stiffened by a large amount of silica (opaline quartz) in the walls, yet it is extremely brittle near the tip. Next, hidden from us now, there was the bulb containing the nettle venom—a container corresponding to the barrel of the hypodermic needle. Finally we found the bulb socket, a part with the same function as the plunger of the man-made instrument or the bulb of a rubber syringe.

This bulb socket surrounds the bulb itself in the same way in which an old-fashioned eggcup holds a soft-boiled egg. The nettle toxin, a poison somewhat similar to the insect venoms, is contained in the bulb in the same way in which fluid is held in the bulb of a medicine dropper.

Marvelous to relate, the bulb is made up of cells with very elastic walls, while the base of the hair shaft itself is toughened with a layer of woody tissue.

Pressure against the tip of the hair does three important things. (1) It breaks off the tiny globular part, which at a point just beneath the ball, is bent at a slight angle something like the spout of an oil can. Being thinner on the concave side than on the back, it breaks off on a slant, and a point like that of a hypodermic needle results. (2) The same pressure that breaks off the tip drives the point of the needle into the skin. (3) At the same time, this compresses the bulb in its socket so that the poison squirts from the tip of the needle. This works in the same way in which downward pressure on the bulb of a medicine dropper held against a table squirts fluid from the tip of the needle.

Contact with the plant causes hundreds of these poison-loaded hairs to go into action. It is not surprising, therefore, that extensive nettle stings sometimes require medical attention. Usually, however, all you need to do is to apply the pulp of a smashed-up dock plant or any plant with slightly acid juice. This stops the burning at once.

All stinging nettles are disagreeable, and the sting of the Western nettle *Urtica gracilis* var. *holosericea,* is unusually painful. But none of our American species can compare with some of the tropical nettles, such as *Urtica stimulans.* This Javanese species is frequently deadly. And the Australian *Laportea,* which was described in NATURAL HISTORY*, is also one of the worst stingers. But of all stinging nettles, the plant of Timor called Devil's-leaf *(Urtica urentissima)* and another species common in the East Indies called *Urtica crenulata* are the absolute limit for pure, vegetable cussedness. An account of being stung by the last-mentioned plant is given by an early French naturalist named Leschenault de la Tour (1773-1826). The symptoms he describes sound like a

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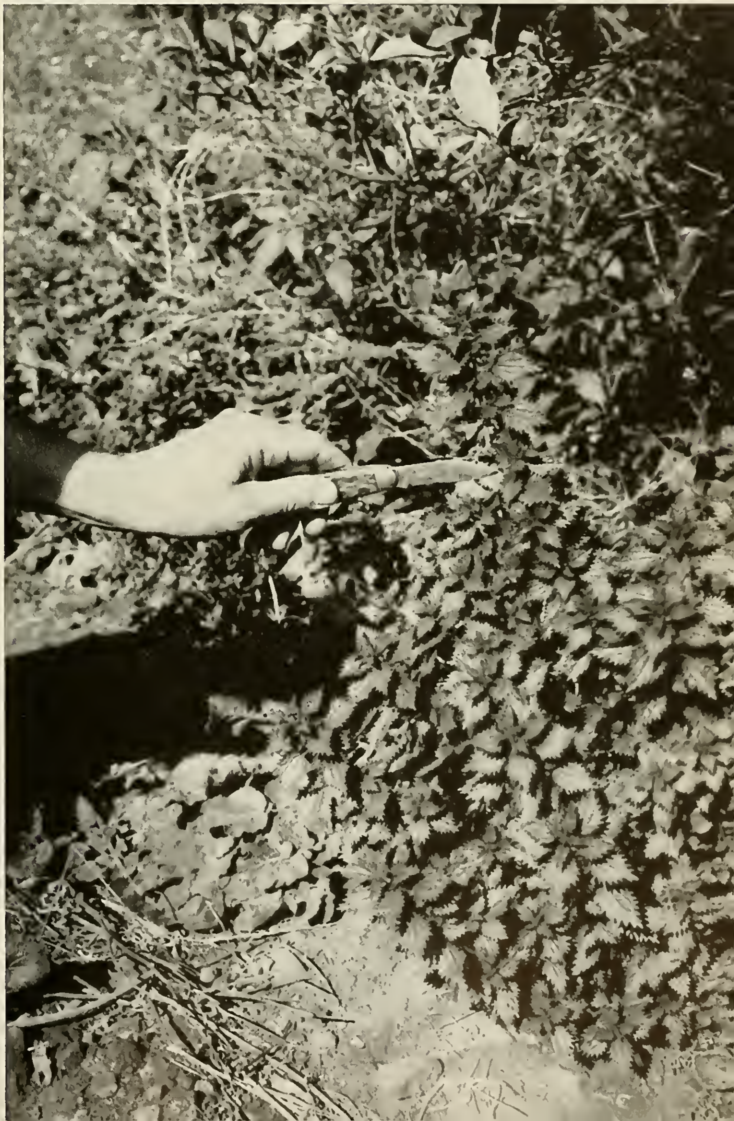
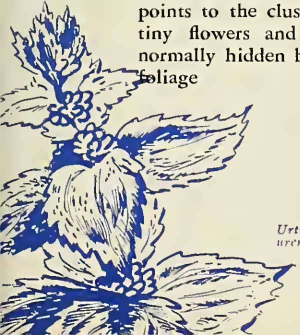
* See "Australia's Stinging Trees," by G. H. H. Tate, NATURAL HISTORY, March, 1949.

Helen Laudermilk photograph



➤ A LUSTY growth of *Urtica,* found in a lemon grove. The knife blade points to the cluster of tiny flowers and fruit normally hidden by the foliage



combination of allergy plus lockjaw:

"One of the leaves slightly touched the first three fingers of my left hand; at the time, I only perceived a slight pricking, to which I paid no attention. This was at seven in the morning. The pain continued to increase; in an hour it had become intolerable; it seemed as if some one were rubbing my fingers with a hot iron. Nevertheless there was no remarkable appearance: neither swelling, nor pustule, nor inflammation. The pain rapidly spread along the arm, as far as the armpit. I was then seized with frequent sneezing and a copious running at the nose, as if I had caught a violent cold in the head. About noon I experienced a painful contraction of the back of the jaws, which made me fear an attack of tetanus. I then went to bed, hoping that repose would alleviate my suffering; but it did not abate; on the contrary, it continued nearly the whole of the following night; but I lost the contraction of the jaws about seven in the evening. The next morning the pain began to leave, and I fell asleep. I continued to suffer for two days; and the pain returned in full force when I put my hand into water. I did not finally lose the pain for nine days."

He was lucky to get out of it in nine days. Some authorities say that the effects of severe stings of certain tropical nettles may last for more than a year.

A classic example of a statement that is only partly true is the generally accepted explanation that the nettle poison is simply formic acid. Chemical tests show that, while some substance that answers to the tests for formic acid and probably *is* formic acid is present, this is only part of the story.

Hegi said around 1912 that the point exudes an albuminous substance having great similarity to snake poison and that it is not formic acid, though it is frequently said to be. Under the microscope, when the toxin exudes from the tips of the hairs, it is seen to be much denser than either water or formic acid. It looks gummy. Hairs containing the toxin, when boiled on a microscope slide in a drop of Millon's reagent (a solution of basic mercuric nitrate), are colored pink. When the hairs are treated with concentrated nitric acid and then with a drop of ammonia

Helen Laudermilk photo

◄ A STINGING DEMON from the Far West: *Urtica gracilis* var. *holosericea.* This large native nettle can raise welts as big as a dime. Fortunately, it is not common and prefers to keep itself in lonely canyons water, they are stained orange. Both these tests are standard reactions for albuminous substances (proteins), so there is no sidestepping the fact that an albuminous constituent is present in the toxin.

To determine whether this substance might not be the toxin itself, I made a test. I scraped hairs from the stems of *Urtica gracilis* until I had a considerable pile of them (75 milligrams). I ground them up in a few drops of distilled water and filtered the solution. I next made two bundles of fine sewing needles and wrapped each bundle in a tuft of absorbent cotton. Now I was ready to make the test.

I repeatedly stroked a fresh, green nettle stem against the inside of my left arm near the elbow. About halfway down, I tattooed a spot with the needles dipped in the hair extract. I then tattooed a third spot, near the wrist, with the needles dipped in pure formic acid.

All the treated spots were about the size of a postage stamp. Number 1, up near the elbow, was a typical nettle burn, at first white, then pink, and finally red. It soon became feverish and *hurt like the devil*. The result of test number 2 was surprisingly mild. Apparently some reaction between the water and the toxin had neutralized the effect. Test 3, with pure formic acid, hurt almost as badly at first as my standard nettle burn. The area also turned white and showed other symptoms of a true nettle burn. But after ten minutes, the pain was nothing to speak of, whereas the spot treated with the nettle still ached and smarted merrily. Like the standard nettle burn, the formic acid area puffed up above the normal level of the skin and turned pinkish brown, and the swollen area spread for about 3/16 of an inch beyond the spot actually tattooed. The pinkish-brown color didn't clear up for two days, although the spot was not inflamed. But what I want to emphasize is that while a sting made with pure formic acid was sharply painful at first, it had none of the punishing, lingering effect of a true nettle burn, which aches and has much the same quality of pain as a wasp or ant sting.

It is rather remarkable that a plant with such a pronounced personality as the nettle hasn't been more extensively regimented for some sort of economic exploitation, since nettle leaves are an important source of chlorophyll for commercial purposes and its fiber is almost as strong as linen and has actually been used as a linen substitute. The promising ramie fiber* comes from a close relative of the nettle. The Cherokee Indians applied the mashed leaves as a remedy for snake bite—apparently with some success. The young shoots are frequently eaten as greens in Europe and to some extent in the eastern states. But as things stand today, the nettle's main claim to distinction appears to be its role as "the plant with the hypodermic needle."

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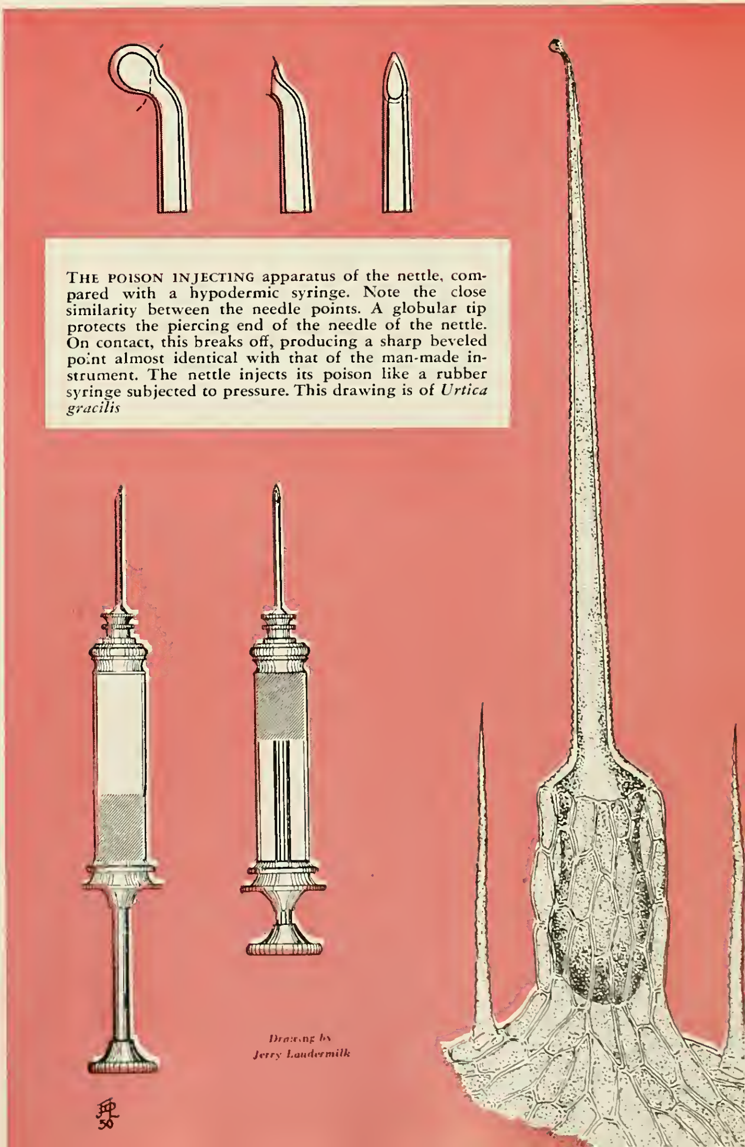
* See "Ramie, the 'Wonder Fiber'," by Eugene W. Nelson, NATURAL HISTORY for January, 1949.



THE POISON INJECTING apparatus of the nettle, compared with a hypodermic syringe. Note the close similarity between the needle points. A globular tip protects the piercing end of the needle of the nettle. On contact, this breaks off, producing a sharp beveled point almost identical with that of the man-made instrument. The nettle injects its poison like a rubber syringe subjected to pressure. This drawing is of *Urtica gracilis*

Drawing by Jerry Laudermilk

The "Screaming Woman

A bit of ornithological detective work exonerates one bird and reveals that the hideous noises were made by one of the most charming creatures among Australia's feathered clan

SINCE the early days of Australian settlement, a great deal of interest and much speculation has centered on the source of bloodcurdling cries uttered by a mysterious night creature in lonely places. Stories of dogs hiding away in stiff-haired terror and horses bolting are part and parcel of the hideous wail.

For many years, bird books have informed us that the culprit is the largest species of Australian night bird, the Powerful Owl, a bird whose impressive appearance lives up to this dread reputation.

However, most "Screaming Woman" reports in the past came from Wimmera, Murray River, and other northern Victorian areas. These regions are not known to be inhabited by the Powerful Owl, which is essentially a dweller in dark, secluded gullies of the big timber, so I had doubts on the subject. These doubts approached certainty when, after close and continuous observation of the Powerful Owl both in captivity and in the wild over a 25-year period, I had not gathered a shred of evidence that this bird ever uttered the frightening nocturnal screeches.

Certain other things had meanwhile given me the inkling that the "Screaming Woman" might actually be the so-called Winking Owl. And when we acquired three of these birds at the Sanctuary at Healesville, I looked forward with more than ordinary interest to the opportunity to listen to their call notes over a long period.

These birds were sent by Mr. J. R. Goodisson, owner of Glenroy Homestead, 20 miles from the Murray River on the comparatively bare plains of Womboota, New South Wales. Mr. Goodisson had discovered the nesting site of the owls inside the leaning trunk of an old gray box tree. The entrance to the deep hollow was seven feet above the ground. He took the three well-grown owlets from the tree in December, 1937, and thoughtfully sent them to the Sanctuary.

The usual call notes of the species began to become a quite familiar nighttime sound on the reserve in the early winter of the following year. But it was not until some two years later, in the early autumn, that—to our excitement and delight—a weird and unearthly cry arose from the aviary one evening after nightfall. After an interval of perhaps ten seconds, this was followed by another cry, and I was there to see as well as hear! Here, at long last, the "Screaming Woman" was indisputably run to earth. It was none other than our bright and vigorous Winking Owl or, as it is now properly called, Barking Owl!

No wonder this call had been a mystery, for only on very rare occasions did the birds scream out in this peculiar tremulous fashion, suggesting, for all the world, a woman's terror-stricken voice shrieking "H-e-l-p!" The scream of the male owl was even more hair-raising than that of the smaller female.

Over the following years it was established that these cries are used mainly in the months of March and April (our autumn). Each screech is single, loud, and forcefully uttered, and may be given at the usual interval of some ten seconds or on odd occasions with minutes between. There is no chorus of screams but simply the rising, tremulous high note. The rarity of the Barking Owl's wavering scream is borne out by Mr. Goodisson's experiences. During the many years that he heard the birds barking regularly, he recalls hearing the drawn-out screaming cry very rarely indeed.

Whether the splendid and much larger Powerful Owl—a member of the same genus—ever utters a maniacal screech under exceptional circumstances is still, perhaps, open to question. With the now remote possibility in mind, I still have the birds under observation.

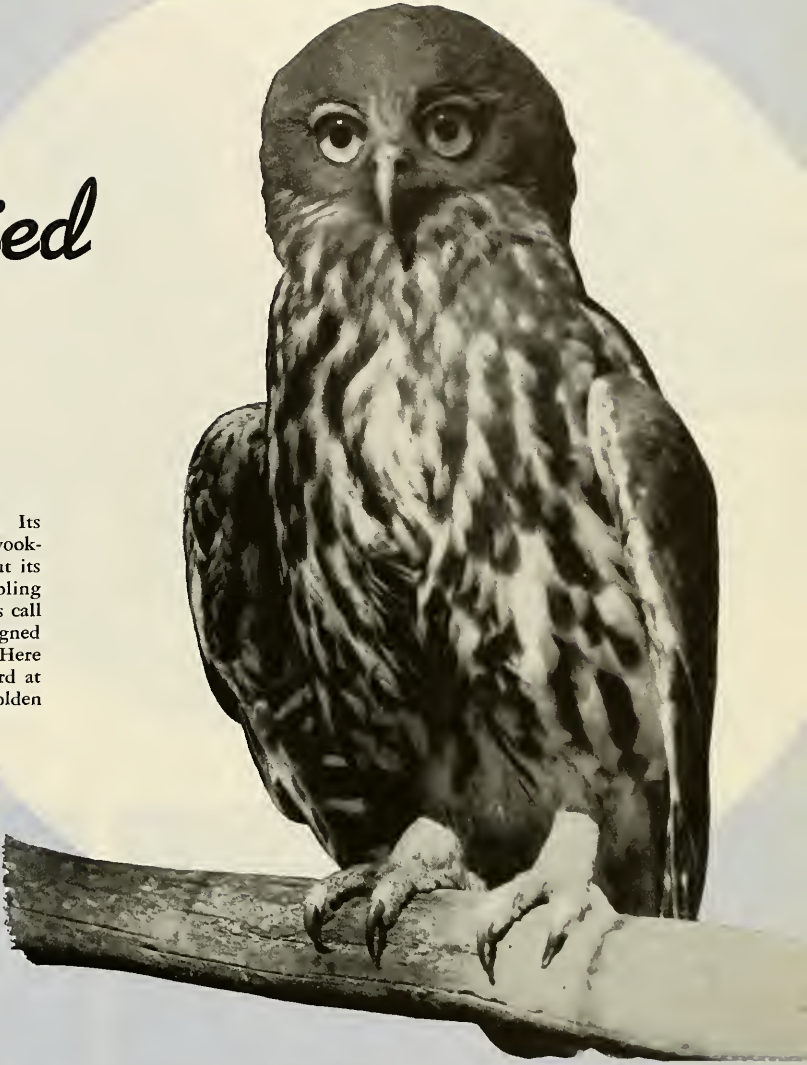
Be that as it may, I regard the Barking Owl as the most charming

Identified

By

David Fleay

Photographs by the author

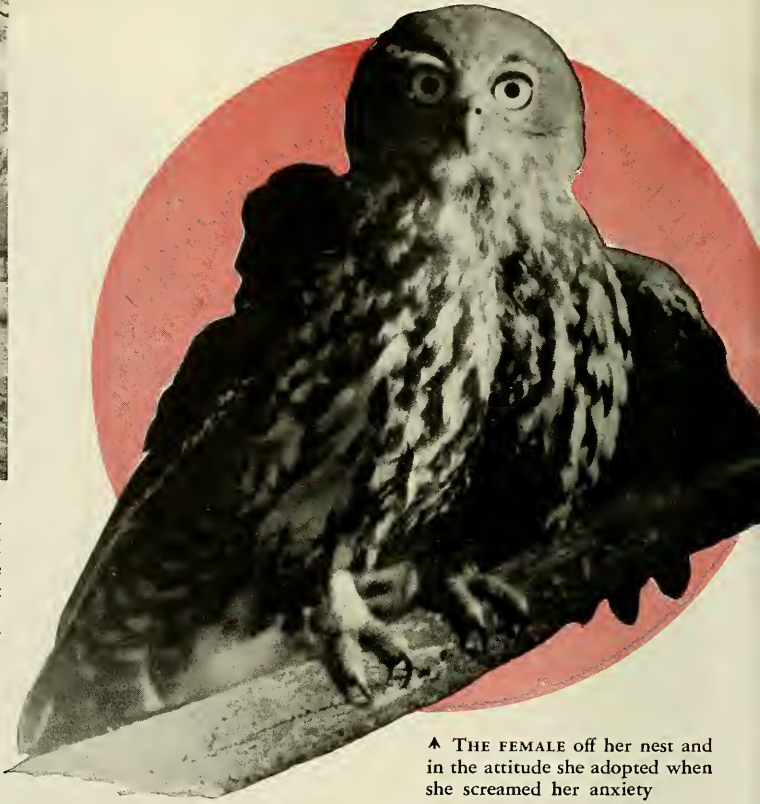


➤ The Barking Owl. Its gruff, almost explosive "wook-wook" is well-known, but its infrequent scream, resembling a terror-stricken woman's call for help, had been assigned to the Powerful Owl. Here we see the male, on guard at the nest. His eyes are golden yellow

of the numerous night birds inhabiting varied environments in Australia. Among them all, this species is outstanding both in regard to its seemingly cheerful, intelligent nature and distinctly absorbing habits. *Ninox connivens,* as it is known technically, is an unusually active and self-possessed owl some twelve inches in height. As implied above, it has been known in our bird books for many years by the common name of Winking Owl. However, it does not blink or wink its golden eyes any oftener than other owls do. More notable is its characteristic, frequent call—an abrupt, gruff, almost explosive "wook-wook"—a call so much like the voice of a dog that at a distance one could pardonably draw false conclusions. Far more appropriate, therefore, is the name of Barking Owl. This name is nowadays becoming the accepted vernacular and will shortly make its appearance in the official check list. Interestingly enough, the name Barking Owl has recently been found to date back over a century to early days of Australian ornithology. It therefore enjoys a distinctive priority over "Winking Owl."

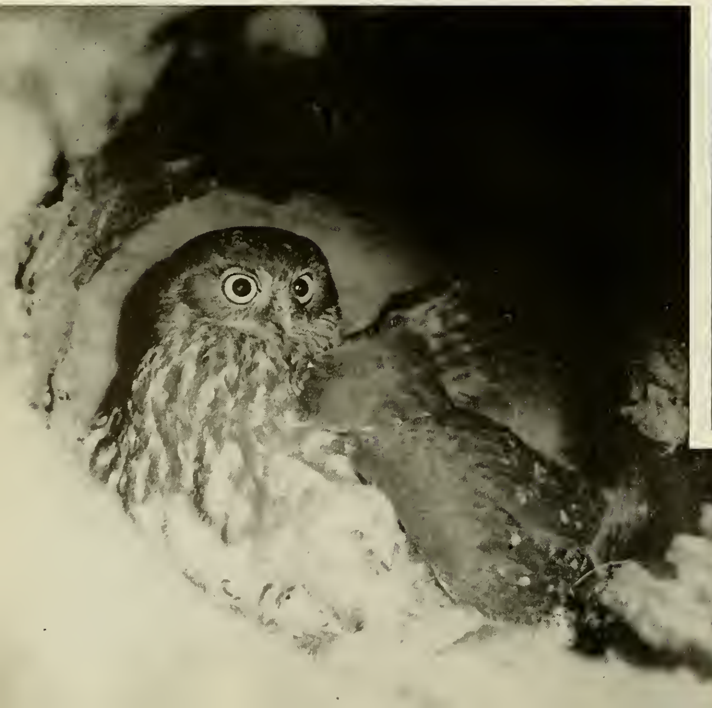
This sturdy grayish owl is also one of the most handsome of the genus *Ninox*. It is widely spread over Australia and is found also in New Guinea and the Molucca Islands, but it is sparse in its distribution and until recently it was little studied. It is about as large as an American crow, and for its

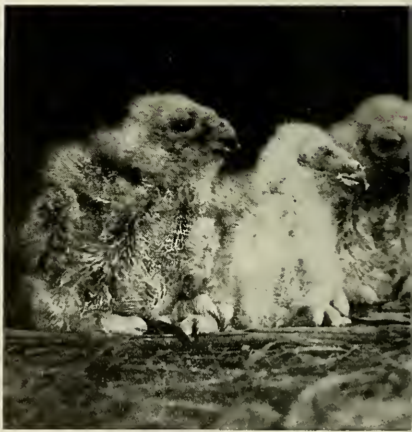
▲ A gray Box Tree, in whose hollow trunk a family of Barking Owls had their nest. The entrance was where the owlets are perched, but the actual nest was down at ground level. A scene on the bare hot plains of Womboota, New South Wales



▲ The female off her nest and in the attitude she adopted when she screamed her anxiety

▼ A flashlight photograph of the nesting hollow, in which only one of the owlets is visible, under the parent's wing





▲ The first Barking Owls to be raised in captivity were hatched three days apart. The oldest here is eleven days out of the shell. Note that the egg-breaking projection near the point of the upper bill is still visible size it is one of Australia's fiercest birds of prey. The male owl is decidedly bigger and stronger than the female, thus reversing the rule so general in hawks, eagles, and owls. These stocky and voracious owls not infrequently kill and eat ring-tailed possums that weigh up to one and three-quarter pounds each. They prey upon magpies, rabbits, young hares, rats, mice, and beetles and other insects. I know of one bird that killed a tawny frogmouth—a member of the whippoorwill tribe almost as large as the owl itself—and devoured its victim in the space of a single night.

These owls lift heavy burdens with surprising ease. On a November evening some years ago, Mr. McInnes of Nanneela, Rochester, Victoria, watched a flock of wild ducks pitch on a water hole. No sooner had they alighted than a Barking Owl swooped down, seized one in its talons, and flew with it to the rail of a fence. The toes and talons of the Barking Owl are well developed and are weapons to be avoided. Although at times the bird dwells and nests in the larger scrubs and fairly dense forest, it is typically an inhabitant of the more open country where there are watercourse woods and scattered clumps of box trees. Northern Victoria's Murray Valley areas and the Hume Highway country from Seymour to Wodonga represent "home" country.

I hope you can capture some of the thrill and romance of working with a living but hitherto "unknown" bird when I tell you how we kept, watched, and eventually bred this alert and lively owl for the first time in order to chronicle its life history.

Eighteen months after the arrival of the first Barking Owls, a fourth specimen, which had been injured by a car near Beaufort, Victoria, was rescued and forwarded to me by Lady White of "Woodnaggerak," Middle Creek. This bird, an adult hen, soon recovered. Though rather nervous, she gradually settled down to new conditions and to the plentiful diet of rats and rabbits upon which all were fed.

Early in 1941, a special enclosure was constructed in peppermint bush completely out of the way of public pathways and disturbances of any kind. There, one of the male Barking Owls and the hen bird from Middle Creek were established on their own. Each aviary now housed a pair of the birds, and subsequent developments fully justified the privacy we had given the two couples.

The aviary in the patch of peppermint timber was near my home, so it was not difficult to keep the birds under observation. During early winter, their barking calls were heard nightly. The rapid double bark resembled "woop-woop," "wook-wook," or "wuk-wuk," according to the fancy of the listener, and there was a considerable difference between the pitch of the male and female voice. The low-pitched, doglike call of the male bird is usually followed quickly by the higher "wok-wok," of the hen, forming a quick firing sequence, given with terrific vigor, until there is a sudden cessation. At close quarters, one detects that these abrupt calls work up from peculiar growling notes resembling "er-wook-wook" until, following several repetitions, the introductory growl is dropped and the clear double call is uttered more loudly. Conversely, the double call may drop back into the growling stage.

The birds dwell in pairs in their natural haunts, and they usually begin their barking call early in the evening, often before it is dark. At times during the night, the barking calls are again heard. But the most curious habit of all, which I have noted quite often while camped in the vicinity of Barking Owl home-sites, is the farewell early morning chorus, uttered in broad daylight before the birds retire to perch in foliage. They do not seem to seek any great protection in daytime but merely compress themselves, if need be, into slim, upright, motionless figures. And they may be heard barking at any time of the day. In fact, the Barking Owl is more noisy

THE BARKING OWL is one of
ustralia's fiercest birds of prey, but
captivity it was found to have a
heerful and intelligent nature. The
hicks became delightful and confid-
g pets. This young member of the
thor's family knows, however, that
eir talons, even at rest, can feel very
arp

and more at home in daytime than any other owl I have ever seen.

The loud calling of our pair in the peppermint aviary practically ceased during the first week of July. At close quarters, single hoarse notes and rumbling peevish notes from the hen were occasionally heard. It was evident from this and from the actions of the male bird that nesting operations had commenced. He spent a good deal of time, both day and night, in scraping a depression in the rotten wood of a large hollow log suspended from the roof. On July 24 (the date varied less than a week in subsequent years), the hen bird laid her first egg in the spot prepared by the male. A complete clutch of three appeared, with an interval of nearly three days between the laying of each egg.

With the hen's retirement, the cock owl became extraordinarily savage. It was positively dangerous to enter the aviary without the protection of a long-handled broom. On one occasion, when I was looking in from the outside, the bird drove his long keen talons through the large-mesh netting and scored my arm. Another day, he drove his claws deep into the back of my hand. Subsequent septic results necessitated antitetanus treatment. The pugnacity of the male bird with his fierce attacks, accompanied by loud snapping of his bill, and the absolute refusal of the hen to be scared off her nest, are typical characteristics of the species in general. In the wild, the owls act similarly though not quite so belligerently.

On August 30, the first owlet was hatched, and the incubation period for each was approximately 37 days. Every time one of us climbed a ladder commanding a view of the hollow-log nursery, both parents screamed in the curious fashion so seldom heard on normal occasions. The hen owl shrieked and snapped her bill from her brooding position, closely covering her offspring and firmly refusing to leave them. Their shrill, trilling voices could be heard from beneath her feathers. On September 9, when the eldest of the owlets was eleven days old, the borrowing of the youngsters for the purposes of a photograph was a most hazardous operation. A bystander might have gotten a good laugh, for I had not only to call in an assistant to ward off the savage aerial attack but was obliged to wear an upturned bucket as a helmet!

The little fellows at this stage showed few indications of their later charming appearance, but the picture obtained at the time clearly shows the disparity in size due to the difference in the times of hatching. From the age of a fortnight onward, the owlets developed rapidly and strongly in spite of the unsanitary state of the hollow-log nest.

At the age of nineteen days, it was evident that the white of the elder youngsters was giving place to a general grayish-colored down. The irises of the eyes, previously greenish in tinge, were showing first signs of the coming golden-yellow. On that day, September 17, I removed the owlets from their parents—experiencing the expected savage attack in doing so. From that stage onward, they were reared at home by hand, with the result that three months later, the young owls became the most delightful, confiding, and interesting feathered creatures it has ever been my pleasure to observe. Normally in the wild, youngsters of this species first venture from the hollow at the age of five weeks, and at four weeks the mother leaves them to their own devices in the hollow during daytime. At this month-old stage, the owlets are clothed in grayish down, mottled grayish-white on the chest and abdomen, closely resembling the adult pattern. A nearly complete whitish collar also distinguishes them from this time until they lose it at the age of two and a half months.

The "triplet" owlets became increasingly active and playful. Their trilling voices, deeper toned than the shrill cricket-like call of baby Boobooks, were continuous; and their ability to wind their heads about on "rubber" necks provided most comical antics. The young birds, with the exception of the undersized baby, could now flutter a few feet, and daily from that time on, their wings gained power. At six weeks, the larger ones flew quite well, but the smallest bird was not strong on the wing until late in October, when it was at least seven weeks old. The birds' talons were painfully sharp and truly uncomfortable when they perched casually upon one's head. The appetites of the young owls were, and still are, enormous. I was kept unusually busy hunting rabbits; and it was not at all uncommon for my three "foster children" to devour a half-grown rabbit among them during the night—fur, bones, stomach and intestines—and then demand more food in the morning. The adults, on the contrary, most carefully discarded the stomach and intestines.

Late in November, when the youngsters were approaching the age of three months, the slate-gray feathering and mottled gray and white of the undersurface began to supersede the immature downy plumage of the owlets. At four months the change-over was complete in the older owlets, though the smallest bird was still lagging behind in development. The bigger birds were by then indistinguishable in appearance from an adult. They were indeed fascinating, lively creatures, ready to perch on one's head, shoulders, or arms, whistling continuously on the slightest possible pretext. Most attractive feature of all was their instantaneous vocal response when I "wook-wooked" to them. To frighten them appeared impossible. Their self-possession was, and still is, phenomenal, making them ideal display birds.

In later years, both parents and young birds have continued to breed, and their progeny were given liberty in the bushland. Still their "wook-wooks" echo about us. Never in my experience has the investigation of the life history of any Australian animal revealed a more charming and delightful subject. The Barking Owl is a personality bird.

▲ **Ghost trees:** silent reminders that forests, like people, suffer from epidemics

Chestnut Blight

A disease that cut a trail of death from Maine to Georgia

By Genevieve Hoehn Bellis

IN THE Blue Ridge Mountains of Virginia stands many a "lonesome pine," famous in song and story. But of the chestnut trees that once flourished in these mountains there remain only slick gray trunks, mute memorials to a great American tragedy. In the accompanying scene at Big Meadows, just off Skyline Drive in the Shenandoah National Park, they appear as tombstones in a veritable chestnut cemetery.

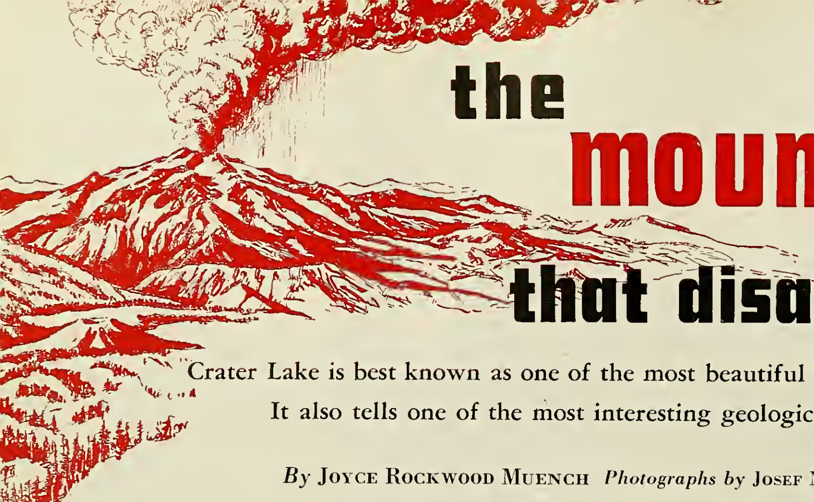
As a fitting memorial to their departed comrades, the living trees of Shenandoah National Park furnish a setting of unsurpassed beauty. The mountain slopes are covered with a splendid variety of hardwood and evergreen trees: oaks, hickories, black locusts, gums, maples, lindens, walnuts, birches, tulip trees, sycamores, elms, cherries, redbuds, dogwoods, pines, red spruce, hemlock, red cedar, yew, and balsam. But the chestnuts live no more.

The chestnut blight was first noted in 1904 in Bronx Park, New York. It had been introduced from the Orient on nursery stock. Fungicides, sprays, and destruction of infected trees failed to check the fungus, and by 1940 it had infected the chestnuts from Maine to Georgia.

The loss of the chestnuts was felt particularly by the Appalachian Mountain people, for whom the trees were an important source of income. The bark was the principal source in the United States of tannic acid, used in curing leather. The nuts were used for food. The timber, coarse-grained and inexpensive, was durable and rot-resistant and was ideal for railroad ties, telephone and telegraph poles, fence posts, shipmasts, and coffins.

When the chestnuts began dying from the blight, some hoped that the new growth might become blight-resistant, but this did not prove true.

Though we mourn the loss of the chestnuts, perhaps they did not die wholly in vain. The tragedy of the chestnut emphasizes the need for constant vigilance in plant quarantine and for greater knowledge of plant diseases and how to control them.



the MOUNTAIN that disappeared

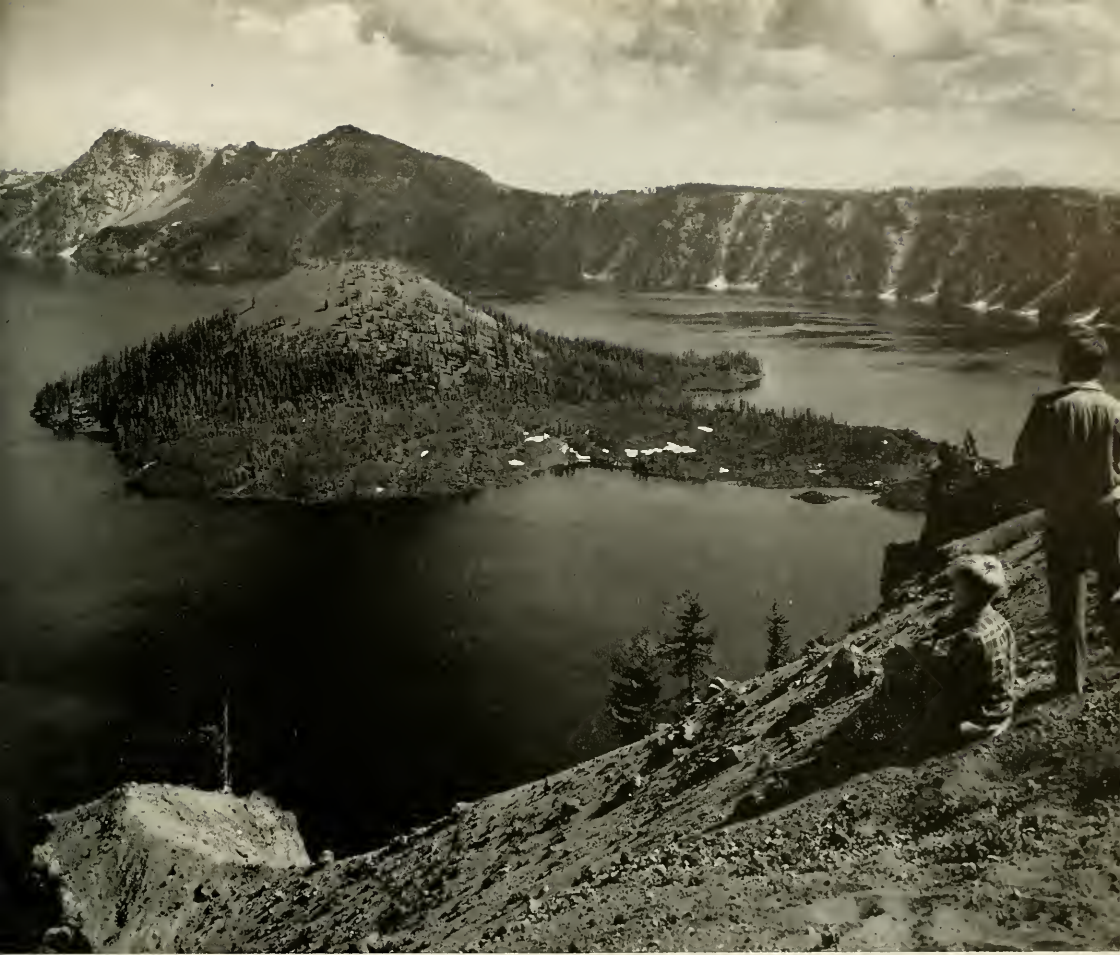
Crater Lake is best known as one of the most beautiful spots on earth. It also tells one of the most interesting geologic stories

By Joyce Rockwood Muench *Photographs by* Josef Muench

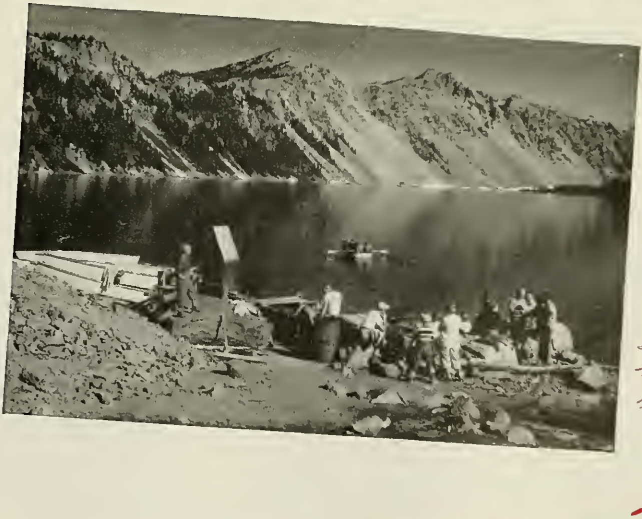
IT'S true that things get lost—eyeglasses and children and insurance policies. Maps point out lost lakes and lost rivers, and I once read of a steel bridge that vanished overnight from its moorings. But that a 12,000-foot mountain could be mislaid seems hard to believe. You can see for yourself, however, a yawning gap in the skyline of the Cascade Range in Oregon, where a snow-bundled peak once stood.

Today there should be great glaciers snaking down its shoulders and between them snowplows clearing roads to lofty ski resorts. In spring, above the meadows bright with flowers, there should be slopes of perpetual snow. There might even be a summer cottage along the deckle edge of forest at one of its alpine lakes—if the mountain hadn't disappeared.

To add to the mystery, the site is covered by a world-famous sheet of water, bluest of the blue—2000-foot-deep Crater Lake. Twenty miles of variegated cliffs hold its crystal-clear water in a bowl six miles across. Jagged notches ornament the cliffs of the torn rim. From its high points, rising 2000

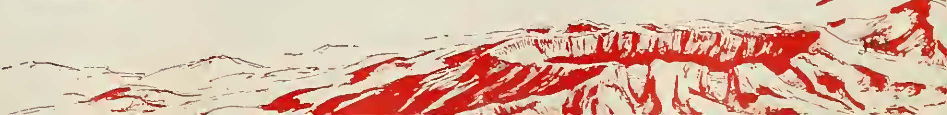


▲ Many visitors to Crater Lake National Park satisfy themselves with the view from the rim, but some of its marvels are best seen from the level of the lake. The lake is six miles across. Wizard Island rises 763 feet above the water



➤ At the shore of the tremendously deep lake, launches and rowboats are available for a more intimate exploration

The Phantom Ship, as this steep let is called, rises 175 feet from the ater. Great depths are recorded, and e launch takes its passengers close the sheer rocks



▲ THE WATCHMAN and Hillman Peak mark the rim of Crater Lake in the wake of the launch. Not long ago geologically, this vast hollow was the interior of a huge volcano. The subterranean fires are now far below the snowbanks that lingered along the water's edge in late spring when this picture was taken

feet above the lake, you can look out over a vast land bearing scars of an old violence partially healed by forest and meadow.

Like conspirators with sealed lips, Union Peak, Mt. Thielsen, and Mt. Bailey look down broodingly from their heights upon the jagged crater. Among the 500-mile assemblage of witnesses, they could tell us, if they would, the fate of their vanished brother peak. Mt. Hood and Mt. Rainier, Mt. Adams, St. Helens, and Baker, lifting burnished heads to the north, are of the same Cascade family and share the secret.

Legend has it that there was some local inquiry at the time of the disappearance. Rumors of

▼ TINY PHANTOM SHIP—an emerald in a crystal-clear sapphire pool. Any view of Crater Lake is beautiful, but this one has rare grandeur

▲ THE WATERS are turned to silver as the camera is pointed toward Mt. Scott on a partly overcast day. These feathery evergreens frame a scene that would be hard to surpass in tranquil beauty

trouble had long disturbed the early Indians of the region. Noisy subterranean altercations, accompanied by rumblings, lightning-like flashes, and showers of rocks, had occurred at intervals on the mountain. The final catastrophe was shrouded in mushrooming clouds and terrific heat that made it impossible to approach closer than 35 miles of the scene. For thousands of square miles, the air was so charged with dust that a continuous twilight ruled for weeks. Awful events could be glimpsed from far away, and every canyon leading down through the forest was a valley of fire. People all around the globe may well have noticed the brilliant red sunrises and sunsets painted by the impalpable dust that hovered in the upper atmosphere.

The Klamath Indians, feeling called upon to fix the responsibility, came up with a report that might be considered unique in the annals of crime. It placed the blame on several gods: Llao (Lay-oh), ruler of the nether regions, immediate superior of all creatures who crawled, burrowed, or lived underwater; Skell, chief of furry animals, birds, and other above-world denizens; and the God-of-all, Telema.

The trouble started, they say, over a woman, daughter of the Chief of the Klamaths. The old man had raised her as an Indian brave because his greatest wish had been for a son, and he was furiously annoyed when both Llao and Skell fell in love with her.

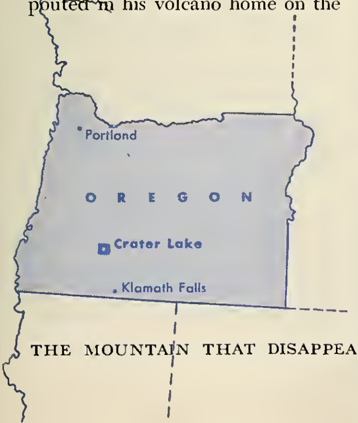
Skell took his refusal like a gentleman and promised eternal protection for the Klamaths. Llao, unused to being denied anything, pouted in his volcano home on the mountain for a while and then sent the Chief an ultimatum. Either the girl would be delivered to him within three days or there would be reprisals.

The girl, true daughter of a Chief, interrupted the tribal council to demand that Llao be placated with her own person, but the Indians tied her to a pole in the tepee, sent a hurried call to Skell, and sat down to await destruction.

Llao brought out rivers of lava and headed them toward the village, which would certainly have been swallowed up if Skell hadn't called upon Telema to step into the row. The God-of-all leveled the mountain, sealing it with a lake, and directed Skell to clear up the tainted atmosphere and restore sunshine after the eruption.

The story might have ended there; but the Klamath Indians, as they passed the account down from father to son and enjoyed its lurid savor around the campfires, continued the legend with other adventures of their favorite hero and villain. There were further conflicts between Llao and Skell; and in the end, Skell cut off Llao's head and hurled it into the lake, where it became Wizard Island.

This legend, conjured up long before white men came to Oregon, leaves certain features of the case unexplained, and colorful though



▲ On the outer slopes of the collapsed volcano, streams have cut through the ancient lava flows and glacial drift to produce these spectacular cliffs. A view in Godfrey Glen

▲ Some persons grow giddy looking at this old tree, which seems to defy gravity. In the distance, Mount Thielsen is visible through the clear mountain air

it is, it need not weigh heavily in our own investigation.

June 12, 1953, will be the hundredth anniversary of the day when the first white man—one John Wesley Hillman—beheld Crater Lake. He looked down upon the wonderful scene from Discovery Point, but his prospecting party was so engrossed in the lesser mystery of the "Lost Cabin Mine" that they ignored the lava-rigged and masted Phantom Ship and completely missed the significance of Wizard Island's fresh volcanic cone. Naming it "Deep Blue Lake," they dismissed the spot as being merely uncommonly beautiful. Ten years passed before other casual prospectors and soldiers dubbed it "Lake Majestic" and "Blue Lake."

Geologists brought the first rays of official inquiry into the picture. When the present name, "Crater Lake," was affixed in 1869, the first strands of the mystery were at last picked up. The title should have been "Caldera Lake," as we shall see later, but the hunt for the real truth was on.

The Civil War was just over, and Oregon had been a State for a decade. Her first railroad was yet to be built, however, and she was far too busy fighting Indians to be greatly concerned over the story of a mountain that had disappeared.

As increasing numbers of explorers chanced upon its lonely setting in the crest of the high Cascades, word trickled through to civilization and started one boy off on a 20-year search for its haunting beauty. It was a decade before William Gladstone Steel could locate any person who had actually visited Crater Lake; and another ten years passed before he finally looked down from the brink at the reflection of the cliffs in a blue mirror and watched the changing light make the Phantom Ship vanish and reappear like magic. Steel dedicated his life to the lake. He stocked it with fish brought in buckets from the Rogue River and persuaded the Government in 1902 to create a National Park of 250 square miles of forest and mountain wonderland.

Thus the splendor of Crater Lake, together with its mystery, was made known and accessible to the American people. Scientific sleuths attacked the problem, bringing to it the skill and knowledge gained from studies of volcanoes past and present the world over. How the cataclysm occurred makes an exciting story, and every visitor who wends his way through the scented forests to Crater Lake becomes a member of the jury, to decide for himself, the case of The Mountain that Disappeared.

Who-dun-it fans may not be surprised that it has been possible to re-create a lifelike picture of the missing peak. It was even christened *in absentia* by a hiking club, and books appeared with elaborate

THIS SPECTACULAR DYKE that runs rom water line to crest is known as the evil's Backbone. It was formed when olten rock thrust itself into a vertical left. It cooled and was later exposed hen the softer rock weathered away

and convincing portraits of it in all of its one-time glory.

Mt. Mazama's family history has been found to go back to the end of Miocene times, some twelve million years ago, when a period of great volcanic activity marked the birth of the mighty Cascade Range. The mountain rose to become a splendid monarch, soaring over 12,000 feet and rivaling Mt. Rainier. Like Shastina on Mt. Shasta, Mazama had Hillman Peak nestled on its slopes, occasionally belching fire from a cone 8156 feet above sea level. Glaciers draped the long slopes, some of them extending for seventeen miles. One of them passed the present site of Crater Lake Lodge and cut a bed for Annie Creek. Two others poured through Sun and Kerr Notches, fed by eternal snow fields on the towering heights far above.

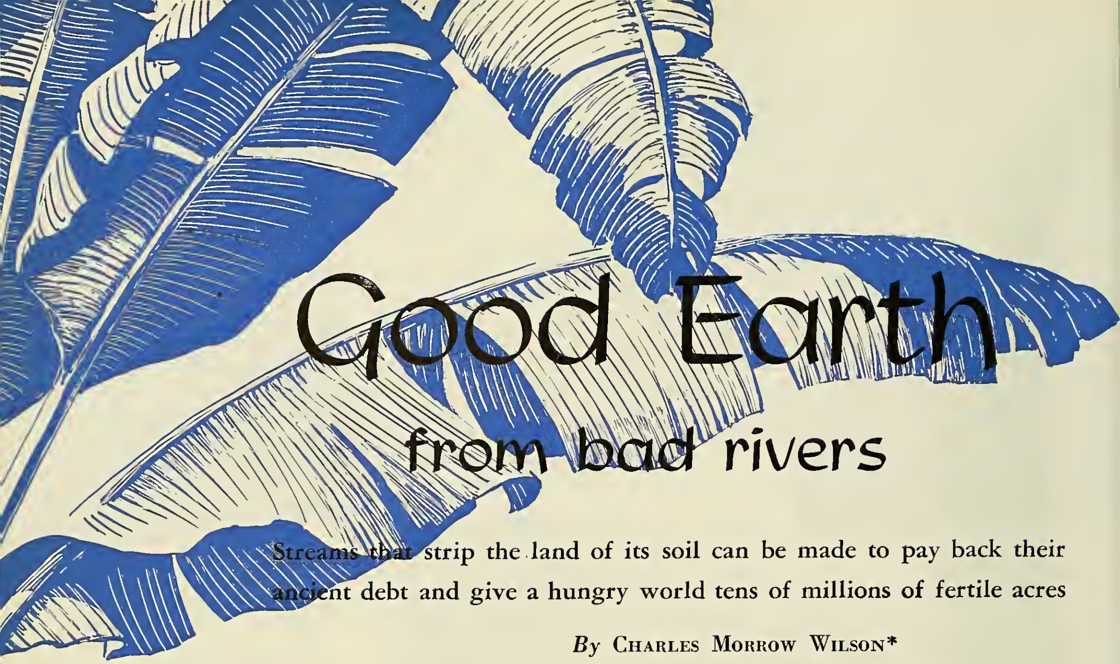
As for the growth and collapse of Mt. Mazama, the layman need only visit Crater Lake to review the steps for himself. Just as the Grand Canyon presents a running journal of the life of the earth, Crater Lake is a legible biography of a volcano. To read its handwriting, you are well advised to hike the mile and a half down 20 switchbacks to the boat landing, because the most telling exhibits are on display along the inner wall. The Park Naturalist, guiding launch parties on the lake, is an able interpreter, ready to explain each point.

Possibly the most fascinating record on the walls is written on Redcloud Cliff, hanging in a great triangular mass above Cloudcap Bay. Here, from lake to rim, seven distinct layers of glacial material recount the successive advance and retreat of glaciers. Benches of loose material, on some of which bushes have taken root, alternate with lava poured over them. The oldest glacial deposits known in the Park are the three lowest layers laid down when the mountain was a youngster, only a few thousand feet high. The growing giant knew long periods of quiet between the successive eruptions.

The launch swings through Grotto Cove, past the Palisades and the slide shaped to a Wineglass formation, to enter Cleetwood Cove and approach the Ragged Crest, the only place on the walls not arranged in layers. Here a dark tongue of lava projects from the water's edge, an "upflow" that occurred long before the death of the mountain. The crust, cooling as it

Continued on page 383

▼ **NO ONE GAZES** upon Crater Lake without bringing away a memory of undreamed-of beauty. The immense depth of the water testifies to the magnitude of the cataclysm that produced this caldera and gives lasting beauty to a scene that acknowledges few rivals for sheer enchantment



Good Earth from bad rivers

Streams that strip the land of its soil can be made to pay back their ancient debt and give a hungry world tens of millions of fertile acres

By Charles Morrow Wilson*

THROUGH the ages man has learned that the topsoil—a surface film averaging a few inches in depth—is one of the most priceless and perishable resources. In one way or another, the world's food supply is dependent almost entirely upon this thin, destructible film.

Water erosion remains the predominant natural destroyer of soils. Rivers, large and small, serve as the principal thieves of the earth. Soil conservation experts believe that the rivers of the United States alone carry away or displace each year enough surface soil to supply food for 10,000,000 people—fertile coverage for some 20,000,000 acres. If only the soils could be recovered and effectively distributed and anchored. . .

Plainly this is an immense *if*. But "immense" is a mild term where loss of soil is concerned. Erosion is a world-wide problem, best estimated in trillions of tons. Recently India's excellent Forest Service declared that river losses of soils now current in that country could readily account for the habitual famine shortage of grains.

The loss of soil to rivers appears to be increasing in most lands, and men have learned to fear and hate rivers instead of loving them as a source of good. Expensively and diligently we seek to control or repress rivers. Only rarely does someone work *with* them. The story I have to tell will acquaint you with a few memorable exceptions of this sort.

For many centuries, the flood plains of the lower Nile have been a proving ground for the recovery of soil from river water. Here, soil-building by "siltation" has been part of the agricultural plan since classic times. Each year the waters are allowed to flood the fields and gardens so that the valuable sediment can be deposited. The ancient plan has been refined in recent decades through the construction of a number of modern dams, by which the water can be allowed to go where it will do the most good at a given time of year.

In general, silt recovery along the Nile is a slow process, requiring an average of about twenty years to accumulate a new soil film five to seven inches deep. The Nile is one of the world's most sluggish rivers. In the final 800 miles of its course, its average grade is only 1 foot in 91,000. The silt load is proportionately light—rarely more than 1 part of fertile soil to 32,000 of water. About a third of an inch of soil is deposited a year.

Thus, one of the rivers theoretically least adaptable to soil recovery has the longest record of achievement through planned siltation. At present, the most dynamic demonstration of siltation is taking place in the valley of a comparatively small heavy-rainfall river. This interesting river is the Ulua of Honduras, with the Chamelécon as its principal tributary. Long before white men came to the Americas, the Indians called the Ulua a "bad river." Cortes gave it a chance to redeem itself when he founded a settlement at its mouth, but the river presently annihilated the settlement.

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* Charles Morrow Wilson brings to this problem of erosion control a lifelong professional interest in agricultural science and journalism. He was raised on a farm in Arkansas and graduated from the University of Arkansas in 1926. Since 1936, he has traveled extensively in the American tropics, sharing in the operation of large rubber and coffee plantations. He is the author of many magazine articles and a number of books on tropical agriculture and related subjects.—Ed.

The Ulua's average annual discharge of water is approximately 550 billion cubic feet. Of this total, about a third passes down the channel during the maximum month—usually October. On a year-round basis, the Ulua carries about 44 times as much silt per cubic foot as the Nile. Its average slope is 20 times as great as the lower Nile's, or 1 foot in 4500, which is typical of many rivers in areas of heavy rainfall, though not of the Amazon or Congo. In the course of any one year, the Ulua carries in suspension enough highly fertile soil to cover about 40 square miles of land 1 foot deep in rich new soil—provided its silt loads can be dropped at the right place and time.

There is little or nothing that can be called exceptional about the Ulua. As indicated, it is a smallish river with a total length of slightly less than 485 miles. Typically, it rises from springs, small lakes, and tributaries in the moderate-rainfall highlands. It gains size from such

▲ A CANAL that will drain the waters after they have deposited their silt. This is the Rio-Tinto-Martinez Canal in Honduras

▼ FIRST MOVE to make a river return its precious load is to study its gradients and the seasonal changes in its volume and load. Flood areas are plotted for intelligent damming

▼ THE ENGINEERING of a siltation project usually requires many boat rides

major tributaries as the Chamelécon and River of Burnt Monkies. It then meanders through about 100 miles of swampy lowlands into the Caribbean. For dimly recorded centuries, it has carried away tremendous but typical loads of soil material and has dealt formidable flood damage to its lowlands during the rainy season.

The one exceptional point is that the Ulua flows through the most productive and most nearly ideal banana-growing lands in use today. Its valley has been famous for bananas for more than half a century.

The banana has long been cultivated, but it continues to be one of the most exacting plants in soil requirements. To produce uniformly marketable fruit, the soil must be extremely rich and well drained. Also, the annual rainfall must exceed 60 inches, preferably 70 to 80, and the plants must have maximum shelter from wind, which can scatter the big heavy-fruited and woodless "trees."

Since 1870 or thereabouts, when the more or less systematic United States banana trade came into being, the Ulua basin has met these exacting standards better than any other sizable land area. Basin soils are so rich and deep that the bulbous roots of the banana plant will endure for a third of a century or longer, and each "stool" or rhizome cluster throws up a giant stem that bears a bunch of fruit weighing 100 pounds or more every 6 months on the average. A single acre of these superior plantings yields 400 or more commercial bunches of fruit —at least 20 tons of saleable fruit each year. Elsewhere, four tons an acre are considered a fair crop.

At current costs, an acre of good banana land usually represents a capital investment of at least $4000, frequently more. The incentive for recovering prime banana land is great.

The two largest banana companies of the present century staked claims in the Ulua basin of Honduras. On the right bank were the preferred lands of United Fruit of Boston; on the left bank, the heavy-yielding banana farms of the Cuyamel Fruit Company. Cuyamel's chief engineer was a South Carolinian named Patrick Meyers. United Fruit's "banana engineer" was and still is an Arkansan named Tom Barnett. Both, for excellent reasons, were spending their best

▲ PREPARING for siltation: an intake canal into which silt-bearing waters will be directed. In a location like this, all the big timber must be cleared away

◄ THE DRAGLINE OPERATOR is the unsung hero in the drama of building soil from rivers

➤ A FLOATING WORK PLATFORM at the end of a large drainage canal years seeking to keep the valuable banana plantings drained and productive and to protect them, as well as possible, from the frequent brown floods dealt by the Ulua.

Saving the banana crops from the angry brown waters and recovering soil materials from the stream became an identical challenge to both. And, oddly, the two young engineers, Meyers and Barnett, working independently and competitively on opposite banks, came to the same conclusions as to how silt recovery could be effected.

One day, Patrick Meyers was trudging through deep mud with the head of his company, Samuel Zemurray. The latter viewed a new and soggy tableland that had been "spilled" by the most recent floods, and exclaimed:

"That's the *natural* way of building lands. Whatever nature does, man should emulate."

We are told that the towering boss became so emphatic that he sank at least a foot deeper into the mire.

Engineer Meyers redoubled his efforts to imitate nature in matters of building new land in the troubled valley. He launched experiments on the left bank of the Chamelécon immediately above its confluence with the Ulua. Within five years he had succeeded in causing the river to build about 5000 acres of fertile land, spread over with rich soils ranging from six inches to ten feet in depth. Meanwhile, several miles below on the Ulua's right bank, Tom Barnett and other engineers employed by United Fruit were carrying on experiments that were also producing results.

The two groups came to certain basic conclusions. They found that a current velocity of between four and five miles an hour (ideally around four and a half miles an hour) was best for soil recovery. Faster currents usually spread rocks, driftwood, heavy gravel, and other undesirable materials over the prospective fields. Slower currents did not carry enough silt to make small water impoundments effective.

The banana engineers experimented with various types of collapsible check dams, designed to draw water from the river channels at desirable times and in desirable quantities. They quickly discovered that the silt-bearing water should be taken out of the channel before it reached flood stage.

In the lowlands, beside the river channels, they then first used draglines or steam shovels to shape small surface canals or "boquerones." These were usually about six feet wide and from two to five feet deep, depending upon grade. They were placed parallel and from 250 to 350 yards apart. They extended for considerable length—two miles or more. Ultimately they emptied into much larger drainage canals designed to carry away the "spent" or largely siltless waters.

By means of the check dam, water was removed from the river channel at or near the best velocity for carrying fine silt. It was guided into the boquerones at reduced speeds established by the predetermined slopes of the canals. Thus, while the channel water was being "swish-swashed," most of the silt load settled and built up the lowlands with preponderantly good and fertile soil. The "spent" water then had to be either returned to the river channel, impounded for later discharge, or preferably carried to the sea by means of a special canal. The latter, of course, is quite expensive, usually costing too much for use in experimental work. As might be imagined, it is usually advisable to anchor the newly recovered soil with a temporary cover crop as soon as possible.

What these men discovered about "siltation" has offered agricultural science a new hope. It has provided an alternative to the ancient idea of controlling rivers solely by means of levees, which in the majority of instances prove to be an expensive and pernicious makeshift.

Levees are embankments built along the shores of rivers to keep their waters from overflowing at times of flood. The river then concentrates all its sediment in its own bed, and the levees have to be built higher and higher. In time, the river is "walking on stilts." Its bottom is far above where it would normally be, and the flatlands are below the level of the river even when it is carrying a normal

▲ BANANA LANDS built by siltation sometimes produce five times as much fruit as other soils. Such valuable areas must be quickly protected with a cover crop as shown here

volume. The silt that might have added fertility to the valley is concentrated at the bottom of the river where its does no one any good, and floods are more serious than they ever were before the river became "elevated."

The principle of siltation, as demonstrated by the Ulua, overcomes the need of levees in many instances and clearly indicates that with time and work, silt-bearing waters can be backed up, pushed around, and otherwise maneuvered to accomplish good rather than harm. Like so many other potentially world-benefiting attainments, the basic idea is "childishly simple." The primary requirement is for accurate, basic engineering, with intense and careful study of the particular river under treatment.

The land-building continued. Along the other bank of the Ulua, Tom Barnett of United Fruit had devoted his entire working hours to thousands of acres of valueless swamps which he felt sure siltation could change into valuable farming land. This tall, thin civil engineer from the Arkansas Ozarks, a graduate of the University of Arkansas, became convinced that in the Ulua valley alone, at least 100,000 acres of then troublesome swampland could be made productive.

After 1931, when Cuyamel and United Fruit joined forces and properties, with Samuel Zemurray heading both, the banana engineers pooled their talents for land-building along the Ulua. By 1940, they had created about 16,000 more acres by land-building on the east bank and additional acreages on the west. Privately owned banana properties, such as Finca Oro and the Birichiche Estate, joined the venture. The total of silt-built lands was more than 30,000 acres when World War II began. War shortages in heavy machinery and ships then impeded the work.

After the war, the soil-building venture began again. At present the "built land" totals about 50,000 acres—almost 80 square miles—with slightly more than half of it planted with bananas or other crops. Experienced engineers agree that if the lower swamps along the Ulua were equipped with discharge canals leading 80 or more miles to the Caribbean, one of the world's richest farming centers would be built from the floodwaters of a typically antisocial river.

Building the discharge canals would require the removal of hundreds of millions of cubic yards of mud by the utilization of floating dredges, which are usually expensive. Depending on many factors, some of which are not easily predictable, it might cost somewhere between $200 and $300 per acre.

In general, land built by siltation is likely to be more expensive than land claimed by the homesteader with ax or machete. But lands recovered from rapacious river currents are often the most fertile of all, and as a rule fertile soil produces better foods in less time and space and at lower unit costs than do the poorer soils.

The Ulua venture impressively indicates that the recovery of soils from rivers is a bright possibility for the harassed flood plains of hundreds of comparable streams. If similar work patterns can be maintained, tens of millions of acres of the most fertile soils on earth can be saved from going into the sea, to produce instead a new and very real avenue to abundance for a world that remains preponderantly hungry.

This goal cannot be attained cheaply or easily or overnight. No two rivers are precisely alike, and each program for soil recovery must be adapted to specific local conditions. Apparently there are no absolute limits as to latitude or longitude, though it is unlikely that rivers in the subarctic could be "treated" effectively. Particularly along the humid flood basins of the Ulua in Honduras, recent and successful experiments are proving that it is not always necessary to build locks or gates in the banks of the river and boquerones or surface canals for "swish-swashing" the silt-laden waters. It is sometimes possible to substitute catch dams and "planned overflows" for building up the primary or leveling soils prior to recovery of the rich river silts suitable for use as surface soils. In these "simplified" ventures the first goal is to establish the primary drainage in the valleys or flood plains that are to be silted, so that the flooding can be managed accurately and when bank

▲ **BANANAS** that would never have been produced without siltation: productivity that urges us to test the value of siltation in other lands and with other crops

levels and silt loads are at the most favorable stages. Engineers employed by the Brazilian Government are currently blueprinting a series of silt-recovery programs for possible use on various streams and rivers of the largest American nation. While specific plans have not yet been announced, there is evidence that the use of methodical siltation is likely to be greatly expanded and extensively improved during the coming decade.

A number of inevitables remain, however. The first, as noted, is that no two rivers are precisely alike, and specific plans must be shaped along lines of sound engineering.

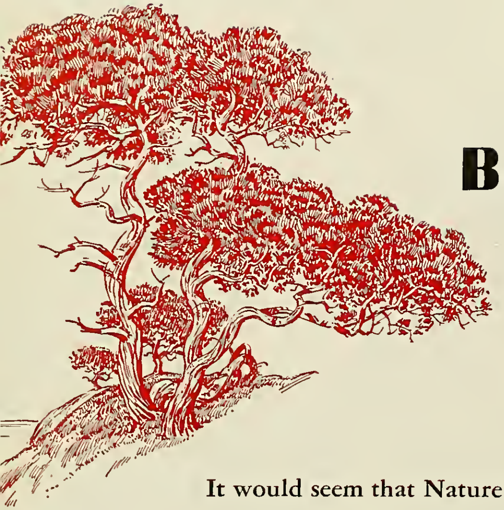
The value of siltation in a given valley will depend on the fertility of the silt. This depends upon the nature of the land along the upper reaches of the river from which, through erosion, the silt is borne down. If it is good topsoil—and it is in many parts of our own country—one must measure the cost of siltation against the cost of other measures to keep the soil in place. If erosion has continued so far that sterile clay is the river's only gift, the silt may be less fertile than the soil already present.

In the humid tropics, the fertility of the silt is determined by different circumstances. In regions of heavy rainfall, the ground water may have washed out much of the fertility. Freshly ejected volcanic material, on the other hand, is known to provide some of the richest soil material in the tropics, and where it is washed into the sea the loss is great. Again, the value of saving it must be measured against the cost of the siltation program, and this depends upon the extent and height of the necessary dams. Some tropical rivers vary 30 feet or more from season to season, and the area flooded is sometimes enormous.

Along the Ulua, silt-built lands have waited an average of three to six years for commercial crops, in some instances longer. Along other river channels 20, 30, or even 50 years might be required. As a rule, much of the work is miry and exhausting, at least to the prospecting or location engineers and their work crews. Frequently the preliminary work must be done by costly trial and error. In one valley, silt recovery by the single acre may be feasible; in another, 50,000 acres or more may be the minimum.

Another broad question is raised by the fact that soil-building by siltation is usually best accomplished for and on large blocks of land. This necessitates the patient co-operation of many individual owners and, in many areas, governmental supervision or assistance. Indeed, the lack of sufficiently large areas of valley land under the same ownership has been pointed out as one of the largest barriers to siltation planning. The experience along the Ulua does not bear out this contention, because the banana companies have been able to work effectively with private owners of riverside lands. In many parts of the world, patient work could be undertaken on public lands. In any case, the real aim is to recover soil that would otherwise be lost or wasted. Thus far, Honduras has pioneered effectively in proving that this objective is attainable.

In lowland Honduras, sun-baked and sun-splashed engineers continue to recover immensely valuable farm sites from the angry brown waters of the Bad River. The Ulua is by no means completely "reformed." But it is being changed from a perennial nuisance and destroyer to one of the more valuable rivers of its size. The men who brought about its reformation took chances. Their bold effort continues to pay off and to shape an even brighter future. Is it not time to examine the "criminal record" of many other rivers to see whether there may not be some good even in the worst of them?



Beach and LODGEPOLE PINE

It would seem that Nature created this incredible tree to confuse the man who would name it, for almost everything it is, it also is not

By Donald Culross Peattie

ON the fog-swept coasts of northern California and thence northward all the way to Alaska, on shifting sand dunes or on the rocky headlands where the North Pacific's tremendous wintry anger is vented in salt spray, there clings and crouches a spindly little pine with dull, dark, scrubby needles and contorted stems and boughs. It is known as the Beach Pine. Sometimes its trunks writhe, prostrate, on the dunes and beaches, and sometimes they are reduced to knee height or hip height and are thin as stalks of reed. Again, a little back from the first fury of wind and spray, the Beach Pine may form a thick-set wood of scrubby growth, just too high to see over and not high enough to give shade. Or there may be a lopsided development of thick-set foliage upon the windward side, forming a sort of natural windbreak behind which, when you are thoroughly exhausted and chilled from the buffeting of the wind, you take a grateful shelter.

Follow the Beach Pine a little farther inland and it becomes a reasonably high tree, growing to as much as 35 feet, with a depressed or irregular dark green crown. The slim trunks, up to 1¼ feet in diameter, are clothed in a dark rough bark, and an extremely heavy crop of small tight cones is borne. These are usually prickly when young, but the eroding weather of the north coast soon polishes them smooth. If the stand is a particularly crowded one, the lower limbs may be lacking, but if the Beach Pine has any space at all in which to spread itself, there is a strange overdevelopment of thickly set branches.

Seeing such a scrublike growth of pine, one would scarcely suspect the age that the Beach Pine can attain. Though they may reach only 40 feet in height in their long battle with the elements, trees 200 years old can be found—possibly ones three centuries old.

A tree with so many distinctive characteristics (most of them on the grotesque side and quite unfitting the tree to be of any value as lumber) would seem to be as sharply set off from other species as one could wish. And yet by insensible gradation, as you follow the Beach Pine away from the beaches into the high coast ranges, it ceases to be a contorted Beach Pine, *Pinus contorta,* and turns little by little into the Lodgepole Pine, a timber tree, tall and slim and dangerously subject, on account of its thin bark, to fire.

Many have been the attempts to separate these two trees along specific lines, but they all break down; and at best the two extreme forms are but poorly marked varieties of the same thing. For they differ not at all in flower and fruit, and in foliage only in the greater narrowness and dark hue of the Beach Pine's needles. It is chiefly in the trunk and bark that one can find any differences. Habitats intermediate between beach and mountain produce trees intermediate in form.

The lumberman, of course, is

Josef Muench photo

▲ LODGEPOLE PINES surround the visitor who tarries at the inviting cabins at the northeast entrance to Yellowstone Park. Soda Butte Creek winds here beneath Amphitheatre Mountain

quite entitled to treat the two as completely distinct, since one is highly useful to him and the other worthless; but the botanist is at liberty to do no such thing. He must treat one as a variety of the other. As it chances, the Beach Pine, *Pinus contorta* proper, was the first one to be discovered, and so the Lodgepole Pine must be considered a variety of it, though it is much the more abundant, grander, and more interesting tree. To it, then, we may turn.

As you cross the Great Plains of Montana or Alberta and reach at last the foot of the Rockies, you see that the slopes are swathed almost to their bases in a great zone of even-aged pines. When living, the foliage of these Lodgepole Pines is yellow-green and thus paler than that of most conifers, though darker than the leaves of their twinkling companions, the Aspens. Frequently, though, hundreds of acres will be crowded with dead yet still standing Lodgepoles, killed by fire or the far more insidious beetle. But even these "ghost forests," as Westerners sometimes call them, are arresting and by moonlight cast an eerie spell; and they but serve, these tree cemeteries, to accentuate by contrast how much wiry vitality there is in the surviving stands. Often these look as if they had been sown from seed all at the same time—so uniform are they in height and dimensions, and this (for reasons to appear) is probably just what happened. Martially straight —straight and slim as poles—these pines, if not individually noble, make, when densely grown over a vast tract of mountain slope or valley, a profound impression of forest grandeur, as great today as when Lewis and Clark, in their toilsome journey by canoe up the Missouri, first beheld their multiple dark lances.

But very different will be your impression if you have come from the magnificently forested Pacific Coast through the western gate of Glacier National Park, for instance —where gracious Hemlocks, giant Cedars, and Douglas Firs grow lushly. For there, when you emerge

Josef Muench photo

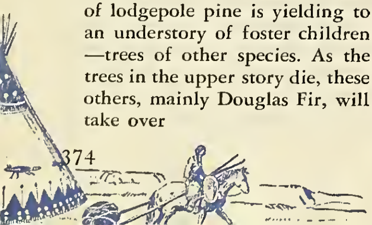
◄ Lodgepole pines flank the Yellowstone River just before the water plunges over the Upper Falls as shown here

on the eastern slopes of the Rockies, the Lodgepole forests seem arid, monotonous, spindling, and thin of shade. Campers and trampers who have tried to make their way through a dense Lodgepole stand, fighting against the dead branches to which the tree perversely clings instead of neatly self-pruning them like other trees, will find little good to say of the Lodgepole. For when one of these pines dies, it finds no room to fall decently, but, caught in the dead branches of its neighbors, it slants halfway to the ground. So an old Lodgepole grove is a perfect jackstraw pile, exasperating and exhausting to the explorer! Yet this is one of the most curious and significant of all Western trees. It has played a great role in the lives of red men and white; its vast domain and numbers would be impressive even were it not rich in human associations. It is at the same time a forest weed and a commercial timber crop, a tinderbox in case of fire and a phoenix after it. And, finally, it is not one sort of tree but two, utterly unlike in every trait except botanical.

At different altitudes and under different conditions of crowding or freedom of growth, Lodgepole takes on these two distinctive forms. They do not differ in flower, cones, or leaves; but in the outline of the tree and the shape of the trunk, they are strikingly unlike. Timberline trees, and those with ample room to develop, have nothing polelike about them. Much nobler in aspect, they have no value as timber. So (and because it is much more abundant), consider first the

U.S. Forest Service photo by K. D. Swan

➤ This 80- to 100-year-old stand of lodgepole pine is yielding to an understory of foster children —trees of other species. As the trees in the upper story die, these others, mainly Douglas Fir, will take over



Josef Muench photo

▲ **Slim and stern** against the snows of winter, the lodgepole lends beauty to the banks of Kaweah River in Sequoia National Park

typical form of the Lodgepole Pine, which is that of a spindling tree growing in a close grove. It may be 50 feet high yet possess a trunk only 5 or 6 inches thick—a true pole.

This form is due to the intensive crowding of the trees where they grow together and form a pure stand of this species alone. And that very crowding is due, in turn, to the behavior of the seedlings, and of the seeds which gave rise to those seedlings, and of the cones in which the seeds were borne. For the cones are often retained, unopened, on the trees for years, but sooner or later fire is almost predestined to sweep through a Lodgepole forest. This was true even before the coming of the white man, for the Indians probably started many fires; and certainly lightning, from the Rockies' abundant and savage summer storms, must for ages have started fires among these trees. The tinder-dry deadwood of the lower branches, the dead trees carried in the arms of the living, the thin bark of the living trees, and the resinous crops of successive seasons' cones, feed a holocaust sometimes unappeased till every Lodgepole within reach of its wind-whipped breath is consumed to the roots.

Yet the seed life, sealed between the scales by a heavy coat of stiff resin, is not killed by the fire. Indeed, the resin is melted, the cones are roasted till their scales pop open, and out leaps the seed crop that has been dormant for years. Thus as many as 100,000 seedling trees will spring up on a single acre of burn. Most of them are destined to be crowded to death, but even so, a great number will survive to maturity and produce a dense stand. So, where the excessive light, heat, cold, drought, and lack of humus of a burned-over area would be fatal to many more aristocratic trees, the indomitable Lodgepole surmounts—indeed it thrives upon—these harsh conditions. If the Lodgepole is gravely subject to fire, it is incomparably adapted to survive and triumph over it. Further, since all the seedlings after a given burn will be of the same age, the stand will be remarkably uniform—which is ideal for the lumber industry, making cutting and milling easy. Many North American pines are similarly adapted to natural reforestation after fire, and even in similar measure dependent on fire for release of the seed crop. But Lodgepole is the archtype of the fire forest, which is as distinctive a formation as the coniferous rain forest of the Olympic peninsula.

Few pines grow more slowly than this one. But the Lodgepoles grow close together, and this helps to make up for it in the matter of timber production. If stands are thinned out, small saw logs can be produced in 60 years; otherwise, you might have to wait 100 years. Growth per acre compares favorably with many other pines, but it can't hold a candle to our Southern pines and Western White Pine. A trunk three feet in diameter is probably the outside limit. And though such poles eventually grow to 50 or even 60 feet tall, that is nothing much in the great coniferous forests in the West. In compensation, there is the fact that Lodgepole

Josef Muench photo

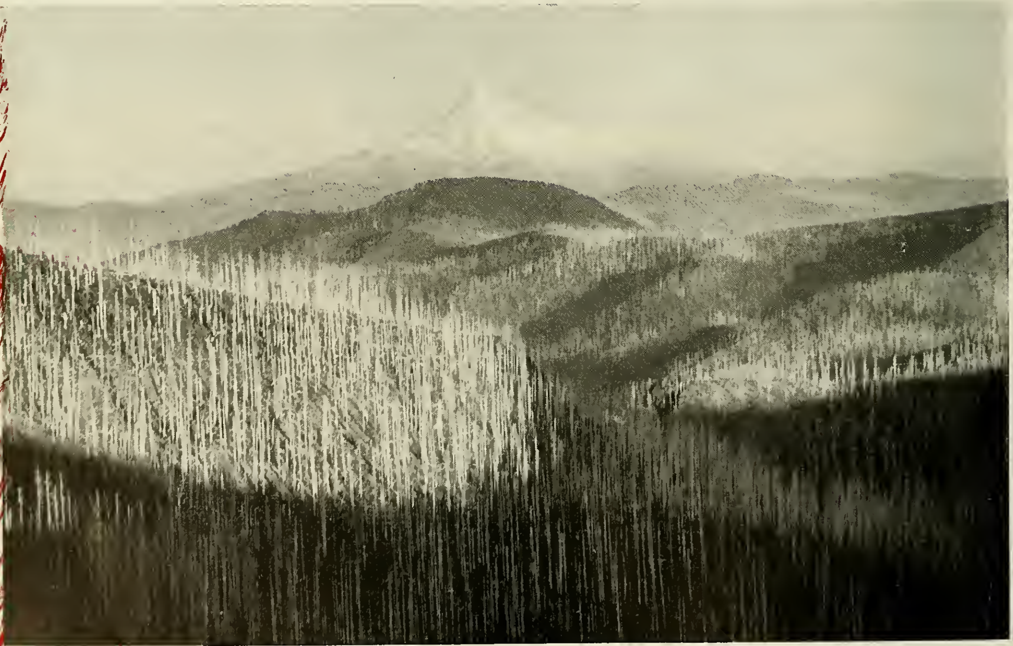
▲ The lodgepole pioneers in the invasion of springy, flat meadows in our western mountains. It has taken over many a beaver pond that has filled with silt and low growth

U.S. Forest Service photo

➤ Slender, straight, and wiry, the lodgepole gave the Indian the poles for his tepee and thus earned its name. Larger specimens provided ties for the first railroads to enter the Rockies. This view is in the Deschutes National Forest, Oregon

▼ Fire frequently turns extensive areas of lodgepole pine into a ghost forest. But this tree can rise like phoenix from its own ashes. The cones are not killed by fire. Roasting often causes them to burst open, thus activating a seed crop that has lain dormant for years. Columbia National Forest, Washington

U. S. Forest photo by Lloyd F. Ryan



may come of cone-bearing age at six years and seldom later than fourteen—a precocity that, linked with its fertility, is almost unparalleled.

Slow as is the growth of Lodgepole, this species has probably greatly increased its acreage in modern times. For, with the increased incidence of fires and the heavy cutting of more valuable trees in so many parts of the West, the Lodgepoles have sprung up over vast areas once occupied by other trees. Moreover, the Lodgepole is a pioneer tree in the invasion of small, flat. springy meadows in the Rockies and the Sierra Nevada, such as are produced when old beaver ponds fill up with silt, sedge, brush, and grass. Slowly but steadily the Lodgepole, encircling such meadows, will creep out upon them and onto the flood plains of mountain rivers, such as the Merced in Yosemite Valley. Within the memory of persons still living, spots in Yosemite that now support a close stand of Lodgepole were once open meadows, bright with wild iris and browsed by deer. The cottages of Yosemite Lodge are set in just such a Lodgepole grove.

Both on a small and a large scale, then, the Lodgepole is an aggressive pioneer of a tree, much like its associate the Aspen. In the ecological succession of trees, Lodgepole should in many places be ousted at length by such shade-tolerant trees as Western Hemlock, but commonly one fire succeeds another so soon (as time is reckoned in the life of a tree) that Lodgepole, which is shade-intolerant and sun-loving in the seedling stage, tends to succeed itself decade after decade. Nor is the forester necessarily sorry. Being more vigorous than spruce or fir, it may be a better producer of wood. Today, Lodgepole covers something like a million square miles, from Alaska to New Mexico and the Sierra Nevada, and much of this is burned-over land that would not be ready for over 100 years to support finer but less vigorous forest types. No one knows from year to year, in so vast an area, how many billion board feet of timber are standing in the form of this species, but there is little doubt that in sheer abundance the Lodgepole is the seventh most common tree in North America.

Lodgepole takes its name from an ancient custom of the Rocky Mountain Indians. In the spring, the Indians would cut the trunks into lengths ten to fifteen feet long and peel off the bark. Then they would set out on their summer hunts, leaving the poles to season until fall. By that time the poles would have become light and were easily dragged or carried by the women into winter camp. Owing to the growth habits of the tree, these poles were nearly of the same thickness (or thinness) over their whole length. Such a pole fifteen feet long might be only two inches in diameter and, when seasoned, would weigh only seven or eight pounds. Furthermore, the wood would be extremely strong, stiff, and nearly impossible to split. When the red men wanted to set up a wigwam, these poles were arranged in a circle inclined inward to the top and there lashed together. Buffalo hides were then stretched on the poles to make the walls of the tepee.

Lodgepole sticks were also the favorite for making the travois, the litter or drag-sled which, in default of any wheels in the life of the Indians, were dragged by dogs or

Josef Muench photo

➤ **Lodgepole pines** may not be called individually noble, but they enhance many a mountain slope and valley and gain a certain grandeur through sheer extent. Kepler Cascade in Yellowstone Park women. With a net or piece of hide stretched between the two poles, the travois became a platform to which bundles could be tied when the tribe was on the move. So great was the demand for poles of this particular tree that the Indians of the Great Plains, who had no suitable trees or only the Cottonwood or Willow, went all the way to the Rockies to cut Lodgepole Pines, or bought them by barter.

When the first white settlers began to move into Lodgepole country, this tree, more than any other, was a boon to their immediate wants. Its polelike trunks made it ideal for fencing corrals, and of it the pioneer built his sheds, stables, and sometimes even his cabin. Later, when orchards began to produce fruit in the northwestern states, Lodgepole furnished a cheap and excellent material for fruit boxes. Then came a need for the first telegraph poles and later for telephone poles; and again this species, when properly treated with preservative, proved ideal, straight-growing yet of twisted sinew within.

From the earliest days of ranching in the West, Lodgepole served, too, for poles and rails in fences, for corrals, small bridges, cattle pens, sheds, and barns. For mine props it is a cheap and substantial timber; even wood that has been standing dead from fire for many years can be treated with creosote and, being very light, put to valuable use in mines. When creosoted, Lodgepole crossties will serve a railroad bed without decay for many years; the very first railroads to enter the Rockies utilized Lodgepole ties. At Horse Creek, in the Wyoming Range, the forests are still levied upon for railway ties. During the winter, lumberjacks fell the ties, saw them into eight-foot lengths, and then, trimming them with broadaxes sharp as razors, stack them up near the streams. When the frozen streams are unlocked by the spring sun, the timbers are floated down to the Green River. Here they are boomed by cables stretched across the creek mouths until water in the river is high enough to float them to the mills. Often when the booms are lifted, there is such a rush of logs that they pile up into a jam. Then men with spiked boots and long pikes walk over the treacherous raft of great poles and work the sticks loose.

Sawmills do not ordinarily list Lodgepole Pine in reports of lumber cut, but all lumbermen know that large quantities are continually cut in Idaho, Montana, Wyoming, and Colorado, even though it goes to market as "White Pine." In spite of some resemblances in color, weight, and grain, and some similarities of use, there are more contrasts between the aristocratic White Pine and Lodgepole than likenesses. Lodgepole is a low-grade lumber. But that does not mean that it is inferior. If the world had only high-grade lumber, we would have to build packing boxes out of Rosewood and fence in pigs with the precious Sitka Spruce. The wiry strength, the heavy-duty capacity, and the cheapness of Lodgepole are not faults even if they are part of the low grade accorded it.

In complete contrast to the Lodgepole as the lumberman knows it—that is, the pole-shaped specimen of the dense, even-aged stand in the fire forest—is the high-altitude and timber-line growth of what is, botanically, identically the same tree. These high mountain specimens grow not in pure stands but scattered amid Alpine Larch, Mountain Hemlock, Alpine Fir, and others. They wear a completely different expression from that of the close-packed typical Lodgepole, as different as is the behavior of a sheep in a flock kept in line by dog and herder, from a lone sheep brought up with children and dogs for playmates. For every close-grown Lodgepole is perforce like the others; every open-grown specimen is an extreme individualist. Shaped by the torque of gales, crouching from the lash of snows, or bent to its knees by mountain slides, its stems often look as if they had writhed as they grew. Comparatively small trees may be—and look—already old, their crowns preternaturally broad in proportion to the foreshortened stem, or lopsided or one-sided. The trunk may become so thickened and shortened as to have a bottle-like swelling at base —this in a Lodgepole! But if conditions are not too harshly arrayed against one of these trees, it may attain, as in the high hanging valleys and "flats" of upper Yosemite, a rude nobility. One specimen measured there is 106 feet tall, with a bole 19 feet around.

These high mountain trees, like the grove trees, often retain their lower branches obstinately but as living, not dead, wood. This gives such specimens a look of indomitable vitality. The bark of polelike trees is a thin skin ranging in tone from the gray of ashes to the black of cinders but in all cases without luster. The bark of the high mountain specimens is thicker, softer, with a warm, living, yellow-brown to ruddy hue, as if it kept some of the afterglow of alpine sunsets.

In these open-growth mountain trees fire probably plays an infrequent part in determining the life span, the opening of cones, or the occurrence or nonoccurrence of seeding. Thus neighboring specimens are not even-aged but may be long tree-generations apart. Possibly the mountain trees are longer-lived, too, being less threatened with fiery death. The thick and crooked-boled individuals could never have been used for the poles of lodges or of travois, and no more would most of them be worth logging today, even if they grew in accessible spots.

Truly these mountain trees have life stories quite as different from those of the pole-stemmed specimens as they are unlike them in appearance, and they deserve a distinctive English name even if they cannot logically be granted a separate botanical one. But there seems to be none as yet. When it is given, let us hope it is not made known by revealed authority of some *deus ex nomenclature* but is born out of the imagination and experience of the Western people, just as was the name Lodgepole itself.

Photo by A. Devaney, Inc.

Good fences are good neighbors

When one man divides his land from another, a newborn world of living things enhances the view of both

By
WILLIAM A. BREYFOGLE

WHETHER or not good fences make good neighbors, good fences *are* good neighbors. And good fences are the kind that take a piece of man's handiwork and turn it into something altogether different—a strip of territory with an economy, a purpose, and a casual beauty of its own.

A good fence is one that has largely put aside its original function as a barrier and become, instead, a sort of city of refuge for living things not tolerated elsewhere. Chokecherry and wild plum find asylum here. The wise woodchuck puts one entrance to his burrow under the protection of the piled rocks that settle a little more firmly into place with each passing year. Snakes bask on those rocks, safe from the mower's scythe. A fox leaps up, runs nimbly for a hundred yards along the topmost rail, and jumps down on the other side, to check and perhaps baffle the hound on his trail.

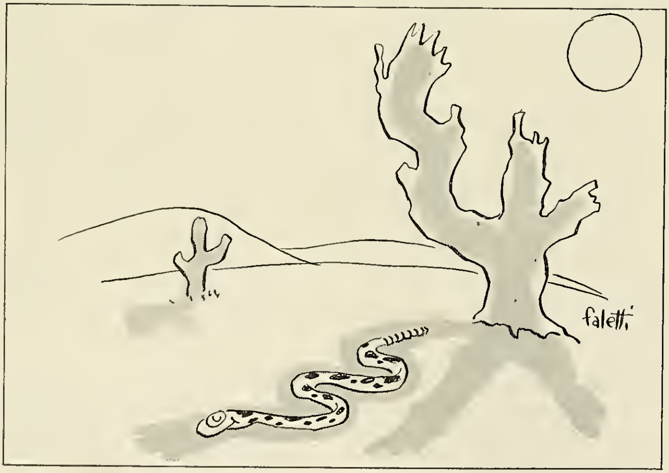
Not only the creatures that must hide or run as a condition of their daily lives are indebted to fences for timely help. In old wars, ragged lines of skirmishers flung themselves down in such a shelter, to pant and reload their hot-barreled muskets. The woodchuck cowered in his burrow beneath them, waiting while these Gods and Titans settled their noisy differences. Bullets tore leaves from the chokecherries and glanced off the rocks, whining as if disappointed.

An old fence stands halfway between the realm of man's cultivation and the richer, more complex world of nature's growth. The fence has something of both, as it has the cosmopolitan quality that comes from a mingling and blending of cultures. Such zones are known for their tolerance. The fence makes no distinction between a squirrel on its weathered rails and a harvester sprawled in its shade at noon. Its life is as infinitely varied as that of any metropolis. Insects that have learned nothing and forgotten nothing for thousands of generations go about their unchanging affairs—the intricate architecture that perfectly meets their needs, the social structure more rigid than any that mankind has ever devised, the warfare involving the ordered movements of armies. Reptiles, birds, and the smaller, warm-blooded animals all have their separate strata, from the mole in his subcellar to the catbird in his penthouse. Like any great city, the place is polyglot with the calls of birds, the vast variety of insect languages, and sometimes the talk of children come to pick wild raspberries.

An old fence is a reminder to man that in the world of living things he is subject to the same laws as his fellow beings. His fence is no sooner in place than it begins to become something he never intended, to be absorbed into a system in which crops and cattle for market are by no means the paramount consideration. The proper business of the fence is now with the abounding, teeming life that sun and rain call into being even in temperate climates. What happens to a fence may remind a thoughtful man of the moss on the roof of his house, the robin nesting under the eaves, and the mouse in his walls. He is never to have things entirely his own way. It is his good fortune to be part of something much too big for his absolute domination. He has a share in an estate much richer than mere tillage and pasture, and it is incumbent upon him to be courteous to the other heirs.

No fence is better worth studying than one that runs across a steep hillside. Say that an angry man wants nothing to do with his neighbor on the lower slopes and puts up a fence to bar all intercourse. The fence transforms this hostile act into a boon. The roots of bushes and trees that grow up unchecked along it hold the soil firmly in place. They stop erosion from cutting gullies through the land below and from leaching all the good out of the soil there.

Along a fence, as elsewhere, the richest trove awaits those who come looking for nothing specific, not even partridges or raspberries. The open-eyed idler is the true inheritor of the richness of the world, whether beside an old fence in an upland pasture or on the streets of New York. He gives himself time to wonder, and what is commonplace to others becomes infinitely precious and rare to him. He walks across a sun-steeped field, and Ormuz and Cathay are waiting for him.



Angular in its own structure, an old fence emphasizes by contrast the grace of the wild plum growing beside it. Stationary itself, it is curiously at one with a bird's flight and the scampering of a squirrel. Utilitarian in its original purpose, it harbors beauty as if that were the only serious business on earth. Built to exclude, it admits and shelters. Fences are paradoxical, and some philosophers have thought that the paradox is the ultimate in human wisdom.

The changing seasons, and the changing weather within each season, work their will on an old fence. They give it a kind of patina as beautiful in its way as the bloom of youth. Each spring there is a new generation of the creatures that live in the shadow of the fence, as each year finds new children in the old streets of London and Paris. The children of the fence burrow among the rocks or perch upon the rails, as forgotten generations have done before them, as the young with much to learn of the world must always do. The wheel of the year comes full circle again, the chokecherries are in bloom once more, and the fence has changed color and shape ever so slightly since last summer. Not enough for the woodchuck and the catbird to notice, but a little.

This change is the price the fence pays for being so thoroughly a part of the restless life thronging all about it, warmed by the same sun, buried under the same snow. It has its history, and every history contemplates an end somewhere in time. Fences are all the better for being less than everlasting. What is important is not that their allotted time runs out but what they did with that allotment while it was theirs. A lump of pure gold may last almost forever. But what is the good of that, when no birds sing above it and it is not dappled every spring with the changing pattern of the new leaves?

The Screen

Authentic comments on films in the field of nature, geography, and exploration

Edited by Elizabeth Downes

"The Big Sky"

"THE BIG SKY," recently released by RKO, is a film based on A. B. Guthrie's novel by the same name. The story is about fur traders and the Blackfoot Indians in the pioneering days of 1832. In the opinion of our scientific reviewer, who has worked among living Indians of North and South America, "The book gives an honest, sensitive, and historically accurate picture of the Blackfoot Indians of this period." However, he finds that the movie version does none of these things.

"After the glowing reviews accorded 'The Big Sky' in some of our leading newspapers and magazines," says Dr. Harry Tschopik of the American Museum's Department of Anthropology, "the film was to me a bitter disappointment. The story deals with attempts on the part of white traders and trappers in 1832 to open the then-unexplored Blackfoot Indian territory on the Upper Missouri River. While such events doubtless took place, the unspoiled Blackfoot are portrayed with the same magnificent disregard for fact that we have learned to expect in the average grade-B horse opera. Although the Blackfoot extras (if, indeed, they are Blackfoot) do not say 'ugh,' they might just as well. They do, however, cruise the Missouri headwaters in birchbark canoes, and their tipis are tastefully furnished with Apache baskets and other bric-a-brac from southern Arizona. From time to time they beat upon tom-toms of a type used by no Indians on earth, and the heroine slinks about in a costume that recalls Minnehaha in a school pageant. At one point, the maiden gives a friend a keepsake as a token of her high esteem. This treasure turns out to be a twentieth-century piece of silver jewelry of the type turned out in quantities by some of our less discriminating Southwestern Indians for the tourist trade.

"It is idle, I suppose, to total these ridiculous inaccuracies, but it does seem high time to question the nigh-universal premise in Hollywood that all Indians were alike, and that even if they differed, the public is too ignorant to be aware of the fact. In the case of this particular film, the movie makers have less excuse than usual for their glaring errors. Clark Wissler's monographs describing in great detail all phases of Blackfoot life have long been anthropological classics. But perhaps it is too much to expect that the purveyors of what passes for history in most movies should be aware of them."

PREVIOUSLY REVIEWED	WHAT THE EXPERTS SAID
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Latuko Pattern of life of an African tribe	True picture of life in the southern Sudan. Excellent color photography
The Navajo Story of an Indian child facing today's problems	Superb documentary film. Photographed wholly in deserts and canyons of Navajo reservation in Arizona
Rhythm on the Reef Deep-sea diving around Cape Verde Islands	200 feet down. Good photographic record. Sea life remarkably abundant
Strange World Amazonian adventure tale	Beautiful but grotesquely inaccurate. Lurid plot
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BOOKS *Continued from page 343*

children differ most conspicuously from the American children described by Dr. Gesell.

This book contributes importantly not only to an understanding of how children of another culture become adults of that culture; it affords us a penetrating insight into why we, as Americans, feel the way we do about our own children and our own child-training practices. Yet although the format of this impressive volume is deceptively popular, its theoretical framework most emphatically is not. It deserves to be read carefully and thoughtfully and, as Dr. Mead would be the first to acknowledge, cautiously.

Harry Tschopik, Jr.

MUSHROOMS OF EASTERN CANADA AND THE UNITED STATES

- - - - - - - - by René Pomerleau

Les Editions Chantecler, Montreal, Canada, $9.00, 303 pp., 70 pp. of illusts.

SEVERAL years ago the Canadian Government made available an excellent book on fungi, which has since gone out of print. Now two Canadians, Dr. René Pomerleau and Mr. H. A. C. Jackson, have joined forces to produce another authentic and very usable book on the more conspicuous forms of mushrooms.

Dr. Pomerleau is certainly well fitted to give accurate information on the fungi for, among his many duties and accomplishments, he is Professor of Forest Pathology and Mycology at Laval University.

He speaks of the enjoyment that comes from eating mushrooms and then makes these remarks: "In addition to taking advantage of this gift laid lavishly at our feet by Nature, we can spend most agreeable hours in the open and use our leisure for excursions which compare favorably with hunting, fishing, and even the game of golf." How very true this statement will ring for those who, after a few summer showers, go mushroom hunting in the forests. The fungi present a vivid and colorful display as well as appealing to one's interest in the grotesque forms found in nature. Last year's display was exceptionally fine in the New England States, where species of fungi that had not appeared for many a year were found growing in profusion.

Then, when we become familiar with the edible species and can carry home with us the treasures found on the excursions, we have a double pleasure: an interesting experience in the field and a delectable meal (free of charge) all for the taking.

This mushroom book is intended for the amateur and includes examples of the more conspicuous groups of fungi, such as the gilled, pored, globular, woody, and coral forms.

For aids in identification, 44 species are illustrated in color, and 127 others are in black and white. There is a key to family groups, and for the gilled species there are keys based on the color of the spores. The author tells how to make spore prints.

Directions are given for collecting and cooking the various edible species, with due warning regarding the dangers of eating species that are not definitely known.

Each species has been given a common name. Some of these are in common usage today, while others are entirely new. Mushrooms are among the plants that are not well enough known to have acquired common names for all species, but since the names attached to them in this book are quite apt, they may become "common" names in the future.

The scientific names are given in both French and English, and synonyms used by other authors are included.

The book is available in both French and English.

Dr. Pomerleau may say that the book is for the amateur, but we feel sure that the advanced student will also wish to add it to his library.

Farida A. Wiley

AMERICAN TREES

- - - - - - - - by Rutherford Platt

Dodd, Mead and Company, $3.50
256 pp., 40 illusts.

THIS book on trees and shrubs is sure to prove very useful both to amateur tree lovers and more sophisticated ones. In general the author's style is telegraphic: "Leaves have sharp angles, lobes are sharp-tipped, bear a tiny bristle." Yet in many places he becomes positively lyrical: ". . . stay a while with the cedars. Then you will touch, feel, and smell the exquisite tapestry of their foliage. You will see how lightly this lifts, rises and falls, like the breast of the breathing forest."

The author explains his system of treatment: 1) the great American woods east of the Rocky Mountains, containing five rather arbitrary subdivisions; 2) Middle West; 3) South; 4) Southern Florida (subtropical); 5) Northwest; 6) California; 7) Southwest. The descriptive matter in the foregoing is supplemented by a guide to the quick identification of trees, using leaf form, seeds, taste and smell, flowers, bark, cones.

For some unexplained reason I missed a few of our common Eastern trees, including upland sumac, our eastern alder, and prickly ash. The tupelo, common enough in New Jersey, is listed as southern. In the section dealing with California, especially, many exotic trees are described. I, for one, would like to be told the names of the families they belong to and their countries of origin.

The excellent drawings by Margaret L. Cosgrove deserves special mention. The color plates are good, but I found the black-and-white pictures better. There is a good index, which includes both scientific and common names of trees and shrubs and also American geographical names.

G. H. H. Tate

WILD FLOWERS FOR YOUR GARDEN

- - - - - - - - - by Helen S. Hull

M. Barrows & Co., $4.95
280 pp., 70 illusts.

ONE of the results of the movement of population from the city to the suburbs is the desire to maintain the suburb site "as is," especially if it contains a bit of woodland or brook or some other natural feature. A manifestation of this is the growing of native flowering plants and ferns in a natural setting.

This book is the story of a suburban dweller whose place was "founded upon a rock" in New Jersey, and who also had some water at hand. She provides lists of plants for sunny rocks, plants for shady rocks, ground cover for woodlands, and plants for bogs and moist places. She especially likes ferns and violets and is also interested in what to plant for birds. Then follows an alphabetical list of states, and a well-known garden contributor from each state has something to say, with a list of what is grown in his or her wild garden. A discussion of the twelve wild garden favorites and the best way to grow them precedes the "A to Z Plant Propagation List," which includes about all the wild plants from alum-root to Zephyranthes. There are chapters telling how to get these wild plants, what to do about soil, and how to exhibit the plants. Some of them are easy to grow while many are rather difficult to maintain. But the unknown factors in growing native plants and the unexplained successes and failures make for interest in the subject. It would be good if we were all physicists, like the author, or chemists when it comes to dealing with these plant problems.

Of surpassing excellence are the sketches of landscape and flowers drawn by Alexander Seidel. There are also fine photographs of individual plants, taken in the author's garden.

Henry K. Svenson

THE MOUNTAIN THAT DISAPPEARED

Continued from page 365

reached the surface, shattered into shiny black glass, while the hot magma beneath continued to push it upward, leaving bristling spires along the rim. A single lava stone, Mazama Rock, 60 feet in height, hangs there, streaked with vermilion bars over its yellow face. It was part of the very body of the peak, torn from its vitals and tossed there by a terrific explosion.

At Pumice Point another exhibit relating to our mountain's checkered career is revealed in a long white bank of pumice, repeating the pattern of glacial periods and lava flows. This porous rock was blown out as gas-rich molten rock, hurled into the air in fiery-red lumps, distended by the expanding gas, and showered upon the earth as white, frothy glass. We have here three successive periods of deposit in a vertical scale towering 50 to 70 feet in height.

Across Steel Bay, Llao Rock seems to hang like a prehistoric bird with wings outstretched. From this point, Skell tossed his foe's head 2000 feet into the serene waters.

The excursion boat glides on, leaving a white wake and lapping wavelets of bluing water, while your attention is directed to the Devil's Backbone. This is a volcanic dike—a flattish mass of igneous rock that was injected while molten into a crack in the rocks. It is the largest of sixteen exposed dikes. Its dense lava has been carved in relief by erosional forces that made off with the softer rock around it.

Hillman Peak, named for Crater Lake's discoverer, juts above the rim at one point. It was cut in half when the parent cone caved in, and you see in cross section the pipe through which it was fed with lava from below. Your question as to how the walls came to be so gaily colored is answered here by the proof of rising liquids and gases decomposing the rocks to make a patina of iron oxides.

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The official tour sweeps on through Skell Channel, separating Wizard Island from the rim and permitting passengers to get a close view of what legend would have us believe is the head of the Klamath Indians' spirit of the underworld. A young volcano in its own right, it rises 763 feet above the water and consists of a rough cone of lava that is hard on shoes. At the top of the cone is a crater 80 feet deep and 400 feet wide.

Investigators first assumed that this was Mt. Mazama's head, until it became apparent that Wizard Island is a mere thousand years old. It must have provided some lively pyrotechnics just about the time that Sunset Crater in Arizona was frightening the prehistoric inhabitants of the San Francisco Peaks. The island is a descendant of Mazama rather than a contemporary, the only child managing to get its head above the water. Several smaller cones are indicated by soundings. Lest you have a moment of uneasiness that new eruptions might upset the boat, the ranger assures you that the heart of Mazama is probably no longer beating and that the mountain is not likely to make any attempt to reappear on the Cascade skyline.

The Watchman, 2000 feet above us as we go through the channel, gets its height from another phase of activity. The opening through which the eruption occurred is right under a man-made tower. An elevation of 8025 feet made it an excellent lookout point, and today the tower is manned in summer by fire wardens, who certainly can't complain of their view.

Crater Lake's other island is the Phantom Ship. Its intriguing shape is due to two kinds of rocks. The sides are of pale green volcanic ash, and the sail-like pinnacles are dark brown to black. The latter are part of a dike, solid material forced when molten into vertical cracks in the paler ash. The pinnacles make 175-foot masts, with tall pine and fir trees adding the appearance of ropes and rigging. From the rim, the formation is seen by many as an old double-masted sailing vessel, cruising on a painted sea.

Summarizing the catastrophic event, about seventeen cubic miles of material vanished in the space of probably only a few days to form this most beautiful lake. Some five cubic miles of that were blown right out, to settle around the lake as pumice and ash and farther away as dust. The walls of the lake were not built up by the explosion. The rim we now see was the base of a great hollow mountain. The huge bowl is not just a crater; it is what is technically called a caldera—the hollow left by the collapse of a volcano. Another five cubic miles of mountain walls must have collapsed to replace the ejected material. And what became of the rest? More than seven cubic miles, heated to liquid, ran down into vast cracks that had opened deep within the inner chamber of the mountain. Having blown its insides, Mt. Mazama swallowed itself!

When the rock cooled and hardened, the watertight bowl was left to catch the rain and melted snow. There is no outlet save springs. The vivid color is caused by the great depth of clear water that scatters sunlight and in the shallow water by algae. Strangely enough, this fiery history occurred during and at the close of the Glacial Period. When Mazama first began to erupt, there was a blanket of ice over Canada and most of our northern states. Glacial deposits are woven into its diary, and in the final death agony, fingers of ice still clung to its flanks, and neighboring peaks reflected the fires in a pinkish glow on their snow. Mt. Mazama's spectacular demise occurred within the last ten thousand years or less. It would be hard to find on the face of the earth so vast a feature that was created so recently—indeed, within the period of man's occupancy of North America.

While we may regret the loss of such a landmark as the mountain would have provided us, none who have seen the ineffable beauty of Crater Lake would willingly see it replaced by another peak.

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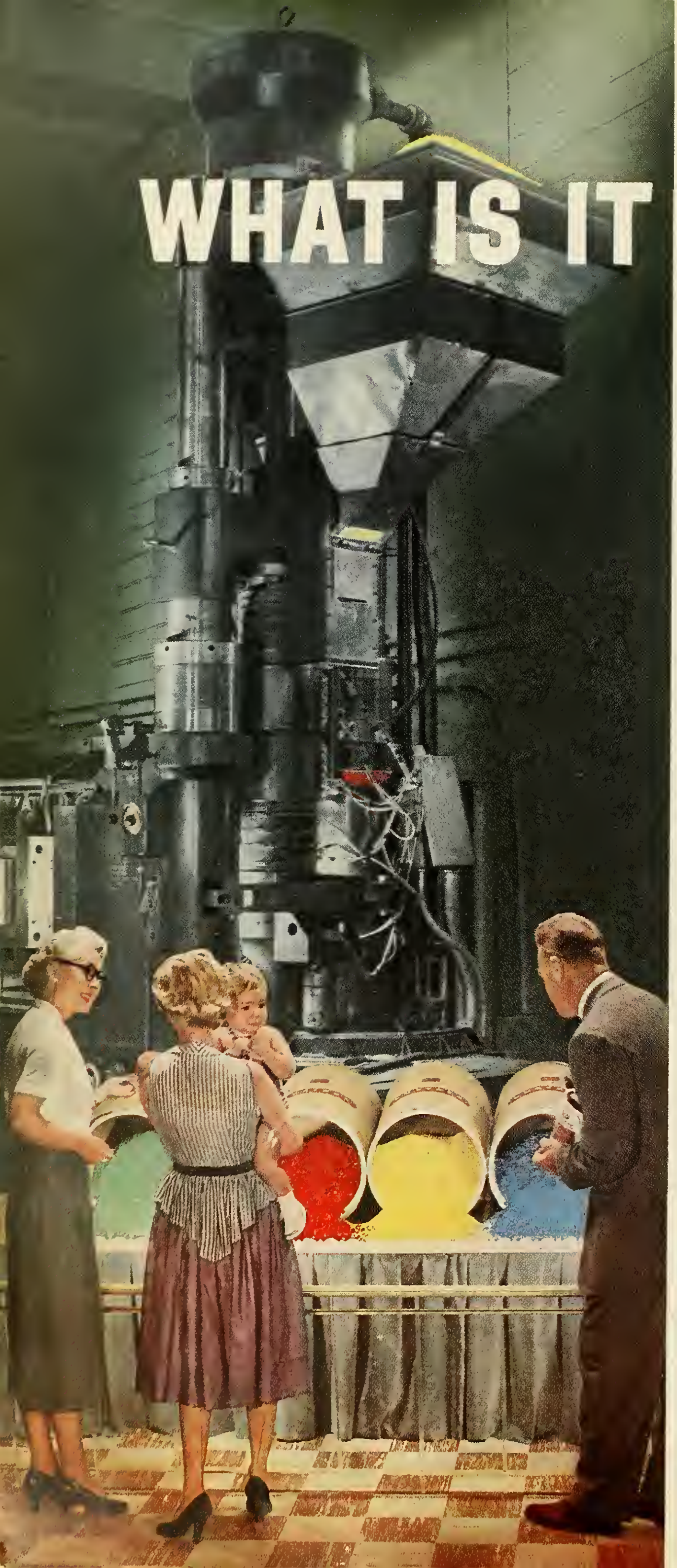

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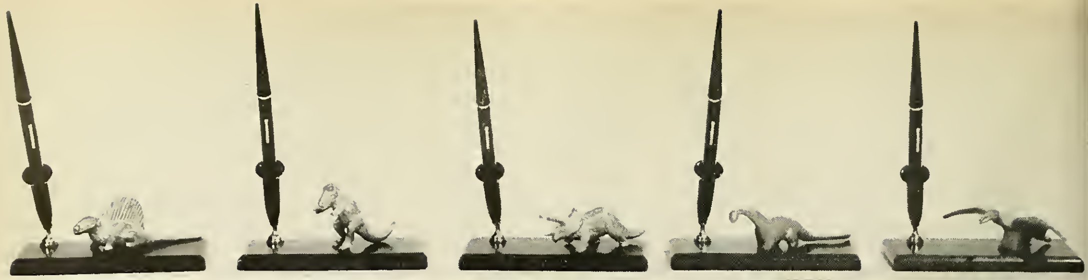

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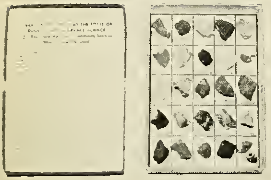

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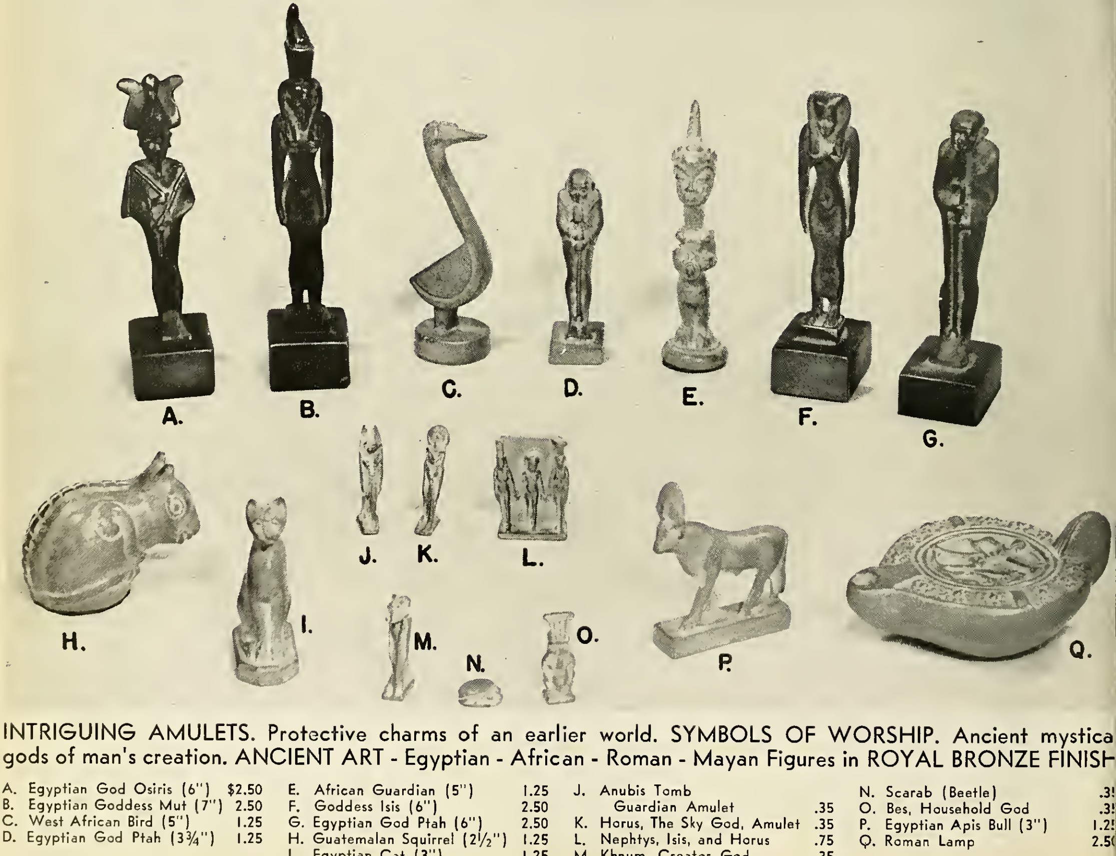

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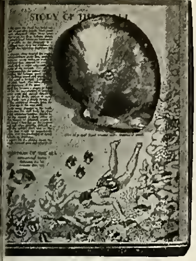
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▲ Wind-combed surf beneath autumn skies: a scene on the California coast looking south toward Morro Rock

LETTERS

Exploding Fishes

Sirs:

My daughter asks a question she would like to have answered. In the book *Diving to Adventure* by Hans Hass, the author mentions that deep sea fishes explode when they come to the surface. In the March issue in one of the science magazines, on the other hand, it is claimed that the opposite is true. Which of the two is right?

Mrs. Emmy Koehler
Denver, Colo.

John T. Nichols, Curator of Fishes at the American Museum, offers the following comments:

"Various fishes found at considerable depths on the continental slope have firm bodies, as do the majority near the surface; and when they are brought to the surface quickly, their stomachs pop out of their mouths. I daresay the air-bladders rupture also, in those that have air-bladders."

P. F. Scholander, of the Marine Biological Laboratory at Woods Hole, Massachusetts, adds that "if a fish with a closed swimbladder is pulled up, it cannot get rid of the gases quickly enough when these expand as the pressure decreases. Very soon the bladder ruptures, and the gases expand through the body cavity, pushing the viscera out through the fish's mouth. If the depth is great enough, the gas also ruptures the lining of the body cavity and finds its way through the connective tissue, bulging the eyes, prolapsing the anus, etc. Fishes whose swimbladders have open ducts may be able to burp the gas out on their way up. In this case, or if they have no swimbladder, nothing will happen.

"Most fishes from abysmal depths have relatively fragile bodies, which often go to pieces when they are brought up. How this fragility relates to the depth is little understood."

Why Wormier Fruit

Sirs:

I was much interested in your recent article about the ruthless and senseless destruction of wildlife. That story should have been told long ago. . . .

I have long maintained the theory that, because of this senseless destruction, we are today paying the price by having wormy fruit in our orchards—such worminess as our great grandfathers never dreamed of. I seem to recall that in my youth, back in the eighties and nineties, the unsprayed apples that I picked in the orchard were clean apples. It was during those decades that the craze for feathers on women's hats spelled the death of millions of birds, perhaps billions of them, many of which were insect and worm eaters. Soon after those decades, we found it necessary to spray our fruit, and today it is almost impossible to get a clean apple without spraying. It is my belief that if those millions or billions of birds had been allowed to live and to breed, we should not have the insect plague from which we are suffering today.

Am I altogether wrong?

Horace J. Fenton.
Laurel, Md.

The following comments are offered by Dr. C. H. Curran of The American Museum's Department of Insects and Spiders:

There are several factors that enter into the interesting question posed by Mr. Fenton, one of which is the trend toward specialized farming, which has been under way since the beginning of

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

Alexander M. White, President — Wayne M. Faunce, Assistant Director In charge of Publications — Albert E. Parr, Director

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THE COVER THIS MONTH

This view of Taos Pueblo, 55 miles northeast of Sante Fe, New Mexico, shows its enchanting beauty probably as effectively as modern photographic techniques permit. This celebrated mecca for artists is now inhabited by almost 1000 Indians, living in their traditional surroundings. Early in the seventeenth century, Taos became the seat of the Spanish mission of San Gerónimo, which was destroyed in the Pueblo Revolt of 1680. Today, the Indians carry on farming and cattle raising and perform interesting ceremonies.

The pueblo is not far from the town of Taos, an important Spanish and Indian trading center in the early days. Now it is famous as an art colony, to which many well-known writers and painters are attracted.

Taos Pueblo is an outstanding example of native Southwestern architecture, and with neighboring historic attractions, a rewarding objective for the traveler in the Southwest.

The color transparency is by the celebrated photographer, Josef Muench.

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THE SHOALS OF CAPRICORN

- - - - - - - - by F. D. Ommanney

Harcourt, Brace and Company, $4.00
322 pp., 15 illusts., map

CERTAIN elements in the terrestrial faunas of Madagascar and neighboring islands suggest the existence of some former connection with India. Islands still remain, to the east and northeast of Madagascar, but they are small and widely scattered. In addition, between the Equator and the Tropic of Capricorn, the ocean is only a few hundred feet deep over a number of shoals, or submarine plateaus.

All the oceans hold vast reserves of food for the human race, yet it takes continued study and hard work to make such resources available. The British Colonial Office in 1947 sent out a small diesel-powered "drifter" to investigate the possibilities for commercial fisheries around the Seychelles, Aldabra, and Mauritius. Two zoologists, John Wheeler and F. D. Ommanney, conducted the ichthyological research, with the aid of the experienced Welsh fishing captain of the 45-ton "Cumulus."

This is not a scientific report on the fishery investigation, though we do learn much about the rich and varied population of edible fishes over the shoals and around the islands studied. The rough coral bottom precludes the use of trawls and other efficient methods as practiced in the colder seas. Most of the fishes will have to be taken with hand lines, yet there are fair prospects of success in some of the more favorable locations.

The book is packed with human interest. Voyages to Mauritius by steamer and to the Seychelles by schooner are amusingly reported. The personalities and activities of the crew of the "Cumulus" add spice to the story. The human communities of overpopulous Mauritius and the languid Seychelles are discussed through a large part of the volume, with excellent historical background and lively sociological observations. The physical nature of the islands is described most accurately.

Scientific names are studiously avoided, yet a great deal of information is supplied about the corals, fishes, and even giant tortoises. Less is said about the birds and pelagic mammals. Dr. Ommanney is to be warmly congratulated on producing such an attractive book as a by-product of his two years of specialized oceanographic study.

JAMES P. CHAPIN

LANDS BEYOND

- - - - - - by L. Sprague de Camp
and Willy Ley

Rinehart & Co., Inc., $4.75, 346 pp.

UNDER this apt and provocative title, Messrs. de Camp and Ley have compounded a delightful potpourri of travelers' tales from the realm of legend, ranging in time from Ulysses to Colonel Fawcett, in space from Ceylon to Peru. "As we can restore a dinosaur from its bones," say the authors, "so can we recreate these imaginary worlds from their traces in literature, folklore, and figures of speech. And a fascinating business it is." This reviewer not only concurs wholeheartedly with the fascination but commends the skill with which the grain of truth has been winnowed from the chaff of fable.

All the old favorites are here—lost Atlantis, the dire Sargasso Sea, elusive El Dorado, the missing Ten Tribes of Israel, and, of course, those marvelous lands and peoples described by Ulysses and Sindbad. To these the authors' clarity of exposition and liveliness of style lend fresh interest. But it is among the lesser known tales that new and intriguing acquaintances are made. There are the one-legged Sciapodae, for example, who lie on their back in the heat and protect themselves from the sun by the shade of their single large foot, or the "no-mouth" Astomi, who subsist "by inhaling the smells of fruits and flowers through their nostrils." There is pleasure, too, and profit, in the changing concepts of the shape and size of the earth. In short, for a One Night's Entertainment both colorful and stimulating, the book can be recommended without reservation. The noteworthy impression that the reader carries away is of the remarkable persistence of some of the legends in similar, or at least recognizable, form. They appear and reappear in literature from classical to contemporary times (the Lemurians, a hangover from the Atlantis theme, bobbed up on Mt. Shasta as late as the 1930's) and confirm in their recurrence the irre-

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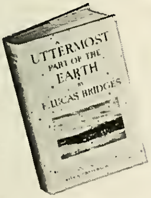

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sistible allure of the unknown. One is reminded of Balboa's aphorism, "Man goes as far as he can, but not as far as he wishes."

WILMA B. FAIRCHILD

ACROSS THE SPACE FRONTIER

- - - - - Edited by Cornelius Ryan

The Viking Press, $3.95
143 pp., 20 illusts.

THIS attractive and informative volume contains, in expanded form, the material on space travel that appeared in *Collier's* magazine of March 22, 1952. That project was inspired by the First Annual Symposium on Space Travel held at the Hayden Planetarium in 1951. It is a nontechnical presentation of the present status and future possibilities of space travel by leading experts in the various fields concerned.

The subjects covered include a discussion of the atmosphere, the design of a three-stage rocket to be employed in building and servicing a man-made satellite, the problems of man's survival in space, the general construction of a station in space, the legal aspects of space travel, and the advantages of an astronomical observatory in space.

Each of these topics is intelligently presented in a concise style by the author best qualified to handle it.

From the point of view of the lay reader, this book seems to answer many questions more directly and with less confusion than some of the other recent space books we have read.

While every chapter is well done, this reviewer was particularly interested in Dr. von Braun's section called, "Prelude to Space Travel," which tells in a fascinating manner about the three-stage rocket and its role in the establishment of a space platform some 1075 miles above the earth, from which it is hoped that man may eventually launch a space ship to the moon.

Mr. Bonestell's beautiful color illustrations add much to the attractive appearance of the book and are invaluable in explaining the text.

ROBERT R. COLES

EAGLE MAN

- - - - - - by Myrtle Jeanne Broley

Pellegrini and Cudahy, $3.50
210 pp., 17 photos

A FEW years ago Mr. Charles L. Broley retired from a position in a Canadian bank and looked about for a new hobby. At the suggestion of Mr. Richard Pough of the American Museum of Natural History, Broley, on a visit to Florida, took along a few bands suitable for marking Bald Eagles. From this beginning came the most remarkable story in the history of bird banding. Remarkable because Mr. Broley at the age of 70 years has now banded some 1200 eagles, and to do so has himself climbed to hundreds of the great nests, which are built in towering pines and cypresses. The Bald Eagle, the National Emblem of the United States, is now in urgent need of further appreciation and protection by the American public. Mr. Broley, through his work and his lectures, has done more for the welfare of this fine bird than any other individual, and the present volume, written by his wife, will accomplish still more.

Broley captured the attention of another group, the scientific students of migratory behavior, when he made the entirely unexpected discovery that the Bald Eagles of Florida, young and old, leave that state as soon as the nestlings are on the wing and fly north to spend the midsummer months in cooler latitudes, north as far as central Canada.

Mrs. Broley, the author of this book, is a member of the Canadian Women's Press Club and writes in a sprightly and informal manner. Her book contains a tremendous amount of information about the Bald Eagle, as well as the story of her husband's exploits. The narrative is carried through the banding season of 1952 and obviously was completed very recently. For this reason one may overlook a certain amount of repetition in the text. "Eagle Man" will be enjoyed by all who are interested in the Bald Eagle, either as a bird or as a historical symbol.

DEAN AMADON

THE OUTDOOR GUIDE

- - - - - - - by Luis M. Henderson

Stackpole and Heck, Inc., New York and Harrisburg, $4.50, 351 pp., numerous line drawings

THIS is a book with a wealth of sage advice for the neophyte camper. The author gives the reader the benefit of his years of experience in hiking and camping, illustrating the book liberally with his own excellent drawings. It is written essentially for the inexperienced person—a primer designed to make the beginner's introduction to outdoor living as painless as possible and to make him aware of the countless things of interest along the trail.

All of the essentials of camping are presented in detail, both in text and in illustration, and the reader will find chapters devoted to such basic considerations as clothing, shelter, the care and use of an ax, food, packs, canoes, and first aid. Of particular interest to the reviewer was a section on the use of aluminum foil in camp cookery—for cups, dishes, pots, baking, etc.—and a chapter entitled "How-to-Make" with its easy-to-follow directions for making sheaths, candleholders, pack frames, and other items useful about camp.

For readers who are interested in wildlife, the chapter on "Tracks and Dens" will be particularly enjoyable. The author describes the habits of animals as they can be read in the tracks they've left. The margins of the pages are filled with drawings of the footprints of a variety of animals, from the lowly field mouse to the wildcat.

Hunting and fishing have been deliberately omitted because it is felt that they would require too much space to treat adequately and because there are already good books available for those who are interested. Altogether, the *Outdoor Guide* contains a prodigious amount of information between its covers and should be on the bookshelf of every aspiring woodsman.

WILLIAM J. SCHWARTING

THE BEST LOVED TREES OF AMERICA

- - - - - - - by Robert S. Lemmon

The American Garden Guild and Doubleday and Co., $3.50
254 pp., 292 illusts.

IN April, 1946, and through subsequent years Mr. Lemmon published all or nearly all of the articles in this book in "The Home Garden" under the general title "The Best Loved Trees of America."

Those articles are now conveniently brought together into one volume. The texts of the articles appear to be alike; the excellent photographs nearly so (a few altered by different enlargements and trimming, but otherwise the same).

The chief virtue of the plan is that identical trees, recognizable by their settings, are shown in full-summer foliage and again in winter with their branches bare. In the case of both deciduous trees and evergreens, outstandingly large, choice examples of their kinds have been selected by the photographers for their subjects. And in addition, small photographic inserts showing details of leaves, bark, flowers, and fruits are offered the reader. No less than 61 of our trees, from all over the United States are so treated.

The texts accompanying the illustrations are all good. Mr. Lemmon knows his trees well.

G. H. H. TATE

THE NORTH AMERICAN BUFFALO

- - - - - - - - - - - - by Gilbert Roe

University of Toronto Press, $12.00
957 pp.

THIS work is the most complete attempt ever made to bring all the known history of the American bison together in one volume, and the author has presented many facts not previously available to the public. After examining this exhaustive treatise, it becomes even more remarkable when one realizes that Gilbert Roe, the author, is self-educated, having left school when scarcely eleven. For 35 years he was in the service of the Canadian National Railroad, nearly half of this time driving a locomotive.

Mr. Roe spent fifteen years gathering his material and has carefully sifted out the actual facts from fiction. He has included in detail all phases of the history of the bison from its first discovery by Europeans about 1530 to the last days of the wild herds on the plains in the 1880's.

At first glance this book may not appear to be suitable for the average man on the street to pick up and read for leisure; but if he is interested in the bison, he will find it both interesting and informative.

In more than 900 pages, the author has arranged his material so systematically that, by using the amplified index, the reader can find any subject on the buffalo with little loss of time.

There are interesting accounts relating to the life history of the bison, its relation to the Indians, the white man, and the wolves. It gives a vivid account of the appalling decline in numbers and the rapid shrinkage of the bison range.

The author has all his facts fully documented and includes a bibliography covering 1000 items consulted.

Gilbert Roe was born at Sheffield, England and spent the early days of his youth homesteading in Alberta. He gathered much of his material on the buffalo firsthand. He is the author of several scientific and historical articles published in England and Canada and was honored with the LL.D. degree by the University of Alberta in 1951.

GEORGE G. GOODWIN

NEW MEXICO: A PAGEANT OF THREE PEOPLES

- - - - - - - - - - by Erna Fergusson

Alfred A. Knopf, 414 pp., 26 photos,
2 maps

AS its title reveals, Miss Fergusson's latest book—her third to deal with the American Southwest—treats the history of New Mexico in terms of the three peoples who successively dominated this semiarid state, and who have all contributed to its present-day population and culture. The Indian, the Spaniard, and the Gringo are skillfully interwoven in a popular history that rarely sacrifices scientific accuracy for pace and color. Such writing is never dull reading.

According to the most conservative reckoning, the story of man in New Mexico covers the great span of some 10,000 years, beginning with the mammoth hunters of Sandia Cave and ending—let us hope, not prophetically—with the atomic bomb plant at Los Alamos. Water has forever been New Mexico's leading problem, and the ways in which it has been utilized by successive peoples with vastly different ways of life is, perhaps, the leitmotif of this book.

Herself a native New Mexican, a daughter of pioneer settlers, Miss Fergus-

Continued on page 429

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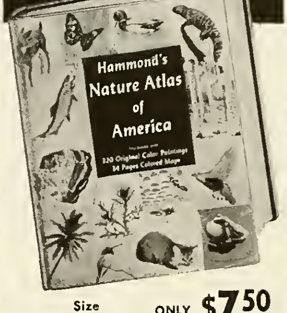

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Editorial Foreword:

It would be difficult to find in all nature a more astonishing relationship than exists between the bird known as the Greater Honey Guide and certain natives of Africa. We are used to seeing pets that will beg for food or pester their master to take them hunting. But where among the creatures of the wild do we see an animal who has repeatedly been described as taking the initiative in coaxing its human neighbors into making a journey to an otherwise unprocurable source of food?

There is no reason to suppose that the bird learns the trick from its parents or by independent reasoning. Psychologists formerly simply called actions of this sort instinctive. More recent students are inclined to avoid that word and to interpret the behavior as a readiness on the part of a given animal to behave in a certain way when confronted with a given set of conditions. Some animal psychologists question whether any of the common activities of birds such as courtship, nest-building, and the care of the young, involve learning or the use of reason.

Certainly, the Honey Guide has no idea of rendering a service to man, and the psychologist may doubt that it knows why it is acting the way it does. Yet after leading the native to a tree trunk containing honey, the bird waits around as though expecting some comb to be left. In its spontaneous partnership with man, this bird has, for some unexplained reason, advanced far beyond even its close relatives. That this delicately adjusted relationship should have become a part of the bird's behavior in the relatively short time that man and bird have lived together poses a riddle on which anyone—expert or layman—may enjoy pondering.

The adventures described in this article were experienced during the first successful attempt to photograph the relationship between the Honey Guide and man.

IN the hinterland of British East Africa lies a vast area which, save for visits by trophy hunters, remains almost unmarked by human hand. Here the King of Beasts roams his kingdom, indulging in Nature's law, "Might makes right." Elephants are its only foresters, pulling down with their trunks food otherwise accessible only to the giraffe's elevated maw. And while the rhino's prehensile lips are busy with lower stuff, cape buffaloes, powerful, intelligent, and vindictive, graze upon sheathing leaves with sullen assurance. Hippos and Biblical leviathans—crocodiles—inhabit the area's rivers; and over its elevated, undulating expanse, hundreds of thousands—no, millions—of zebras and antelopes move slowly and gracefully from great pasture to great pasture. Of course, during the night some of

The Wandoro

▼ THE WANDOROBO following the Honey Guide as has long been their custom. When the bird gave its call, the natives returned it, and the Honey Guide led them unmistakably toward the tree where the honey was

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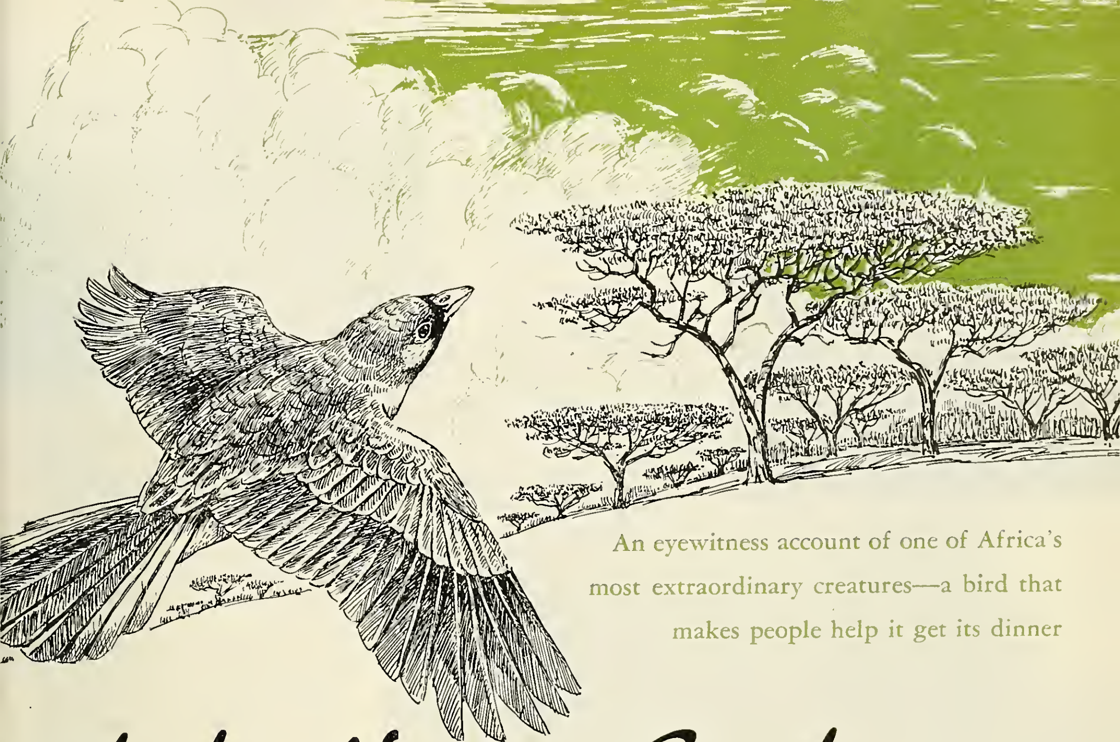

An eyewitness account of one of Africa's most extraordinary creatures—a bird that makes people help it get its dinner

nd the Honey Guide

By Edgar Monsanto Queeny

Photographs by Donald I. Ker

them vanish; the big cats, too, must live. And by day, thousands of scurrying hoofs try to maintain a distance from packs of wild dogs, but some fail, the action being patroled from aloft by the exultant eyes of vultures and marabou storks.

This great animal kingdom is not preserved by fences or officious regulation. The tsetse fly is its very effective guardian. By biting any interloping horses or native cattle, it deals them slow and certain death from nagana, a disease from which the wild animals seem immune, though they carry the organism causing it. Some species of tsetse carry the germ of somnolence and another death to man—sleeping sickness. Hence neither white men nor the Masai, who with their vast herds roam beyond the borders of the tsetse's domain, venture to live within it.

However, there are exceptions—the Wandorobo. These people are a subtribe of the colorful Masai, East Africa's nomadic lion-spearing tribe who scorn the white man's way of life.

The Wandorobo have no cattle, no permanent manyattas, or huts. They are true Tarzans—nomads who survive only through their intimate knowledge of nature. They know which fruits and roots are poisonous and which are edible. With poisoned arrows, they shoot topi, waterbuck, zebra, and eland, whose meat they roast on fires made in true Boy Scout fashion—by the twirling of a hardwood stick in one of softwood. At night, the Wandorobo sleep wherever their day's journeys have carried them, making fires and surrounding themselves with *bomas,* thornbush fences that ward off hyenas, leopards, and lions.

Retaining many of the Masai ornamentations, the Wandorobo are picturesque. Their hair is often bleached with cow urine, and they affect beads. Huge copper wire earrings hang from their elongated lobes, and they smear their faces and bodies with rancid fat and red ocher. Their feet are protected by skin sandals. Wandorobo clothing consists of goat or antelope skins fastened over one shoulder, beneath which may be a cloth, usually the color of burnt sienna. Strapped to the left arm is a *simi* —a long, wicked knife. The left

▲ THE author, dressed for photography at the bee tree

hand also carries a bow, usually held upright when walking. They have the characteristic Masai gait, the right knee flexing slightly soon after the weight of the body is shifted to it. Slung over the right shoulder is a quiver containing poisoned arrows and fire sticks, and a small skin pouch used as a honey bag.

Wild honey, a staple in the Wandorobo's elementary fare and his only sweet, is secured through a unique and ancient association that the people have established with a bird. Armchair ornithologists discredited early reports of this partnership. Confirmatory accounts persisted, however, until the scientific world acknowledged that in many parts of Africa this bird actually leads the natives to trees containing honeycombs. When the natives have split open the tree trunk and taken the honey, the bird feeds on the wax and grubs remaining.

This bird is the Greater Honey Guide, scientifically called *Indicator indicator.* There are other species of Honey Guides to be found in Africa, but there is no confirmed record of their leading humans to wild bees' nests. It is considered possible, however, that other species call upon the co-operation of some honey-loving animals such as the Honey Badger, in the way that the Greater Honey Guide calls upon man.

Greater Honey Guides are brownish-gray birds, whitish on the breast, a trifle smaller than our robin. The male is distinguished by his blackish throat and pink bill. The female's throat is colored like her breast, and her bill is often ashy-black. Both have white outer tail feathers, which are conspicuous when the bird takes wing. They have the cuckoo-like habit of depositing their eggs in other birds' nests, usually in those of woodpeckers, barbets, or bee eaters. Nature has protected them from bees by an unusually thick, tough skin.

With the aid of Major Temple-Boreham, who is the kind, knowledgeable Game Warden of part of the tsetse's domain, we filmed and recorded some aspects of Wandorobo life, including an episode of this unique co-operation between man and bird. We were camping on the beautiful Mara River, whose parklike banks hid heavily armored crocodiles and supported wild fig trees, which were the haunts of noisy baboons. The earth around its tawny pools was heavily printed by innumerable hoofs. There three Wandorobo were brought to camp by one of Major Temple-Boreham's Masai game scouts. For our cameras, they built *bomas* and poisoned their arrows with an extract of the twigs of the small olive-like acocanthera tree. When such a poisoned arrow enters any animal, even an elephant, the creature is certain to die within 20 minutes. After shooting an animal, the Wandorobo wait

▲ HEARING HIS voice played back: Jingwa Oli Naisho, one of the natives who participated in the filming of the Honey Guide's strange performance

➤ TWO stars of the educational film on the Honey Guide examining rush prints of themselves

< AFTER a quarter of an hour, the bird lit on a branch of this tree, and the bees' nest was found in the trunk a few feet below

the allotted time and then either follow the spoor or scan the sky, knowing that wherever vultures gather, their quarry has died, and they proceed to it. The poison, which enters the blood stream, does not taint the meat; all is edible except the part within six inches or so of the wound.

One morning we heard the chatter of a Honey Guide. Our three Wandorobos, named Koaigige Oli Sene, Sabartwa Oli Roisa, and Jingwa Oli Naisho, whistled a response.* The bird was located in a near-by thorn tree. Sensing that the Wandorobo had spotted her, she flew to another tree, chattering excitedly. The Wandorobo answered with low, musical whistling. On she flew from tree to tree, chattering from each perch as the men followed. After a quarter of an hour, she lit on a forking branch of an Ekebergia, a hardwood. Here her chatter climbed several decibels. A few feet below her we spied an old scarred knothole which had originated many years ago, perhaps when a passing elephant tore off a limb. Through this hole bees were streaming to and from the tree's hollow trunk!

Quickly the Wandorobo glued their ears to the trunk. The buzzing within fixed the location of the hive.

In a minute their fire sticks created a fire, which supplied torches, the smoke of which was used to ward off and stupefy the bees.

∨ THE NATIVES started chopping their way into the honeycomb

∨ MYRIADS of resentful bees flew out of the knothole and stung the men repeatedly

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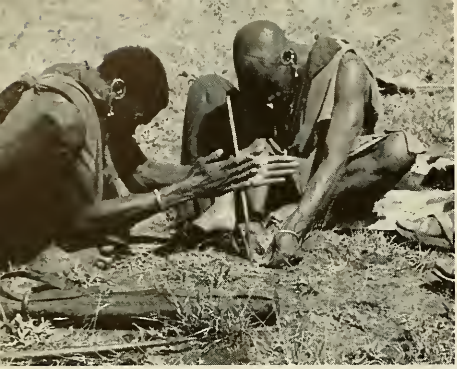
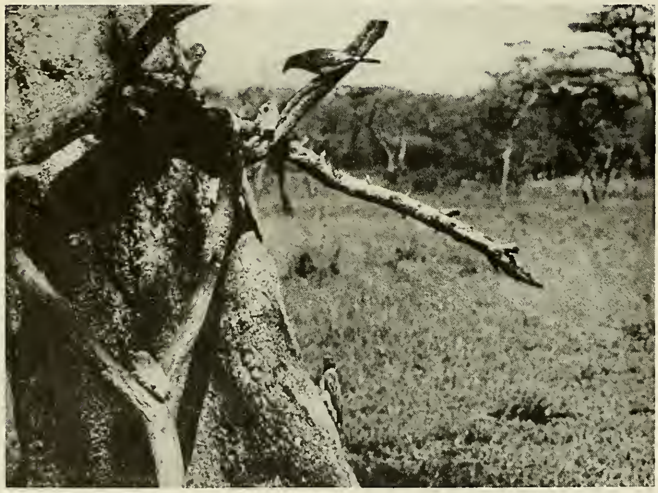
* In these personal names, Oli means "Son of."



▲ To combat the bees, they kindled a fire by twirling a hardwood stick in a small piece of softwood

➤ Within one minute, the hot ash produced by the twirling stick was scraped off into dry grass and blown into a flame

▼ After the natives had extracted the honey, the Honey Guides claimed their reward. The lower bird is a male, the upper one a female



Soon their *simis* had chopped a gaping hole in the trunk. As they worked, myriads of resentful bees boiled out of the knothole, clouded about the men, and despite the smoking torches, stung them repeatedly. Wandorobo skin, however, appeared almost immune.

When the hive was reached, Koaigige, Sabartwa, and Jingwa quickly divided the golden honey and placed offerings for the bird. Immediately after they departed, she dropped to the base of the tree to claim her reward. Soon she was joined by a male. Both fed upon the wax and grubs before our cameras and microphones, which we were operating from well-placed blinds. We had recorded the sound and action of the entire episode, from the Honey Guide's first chatter to her final satisfaction.*

At one time this unique partnership between man and bird prevailed over the greater part of Africa. It was, for instance, an essential activity in the lives of the Kikuyu, who live near Nairobi. But wherever white man encroaches, money is introduced and becomes integrated with the native economy. The natives then earn money-wages and learn to sell their ivory, skins, hides, and crops for money. This sophistication inaugurates white man's scheme of the "division of labor." Trading stores spring up, and the natives buy their sweets from Indian merchants instead of securing them from nature.

Hence, near Nairobi and wherever white man's ways have become established, *Indicator indicator* finds fewer and fewer natives who will respond to its call. In these areas, generations of co-operation have come to an end and the unique partnership has withered away.

Hence the tsetse fly, by warding off whites and pastoral natives from British East Africa's hinterland, has preserved this area's own unique and primitive order—its fascinating fauna, the colorful Wandorobo, and this very singular and perhaps transitory partnership between man and bird.

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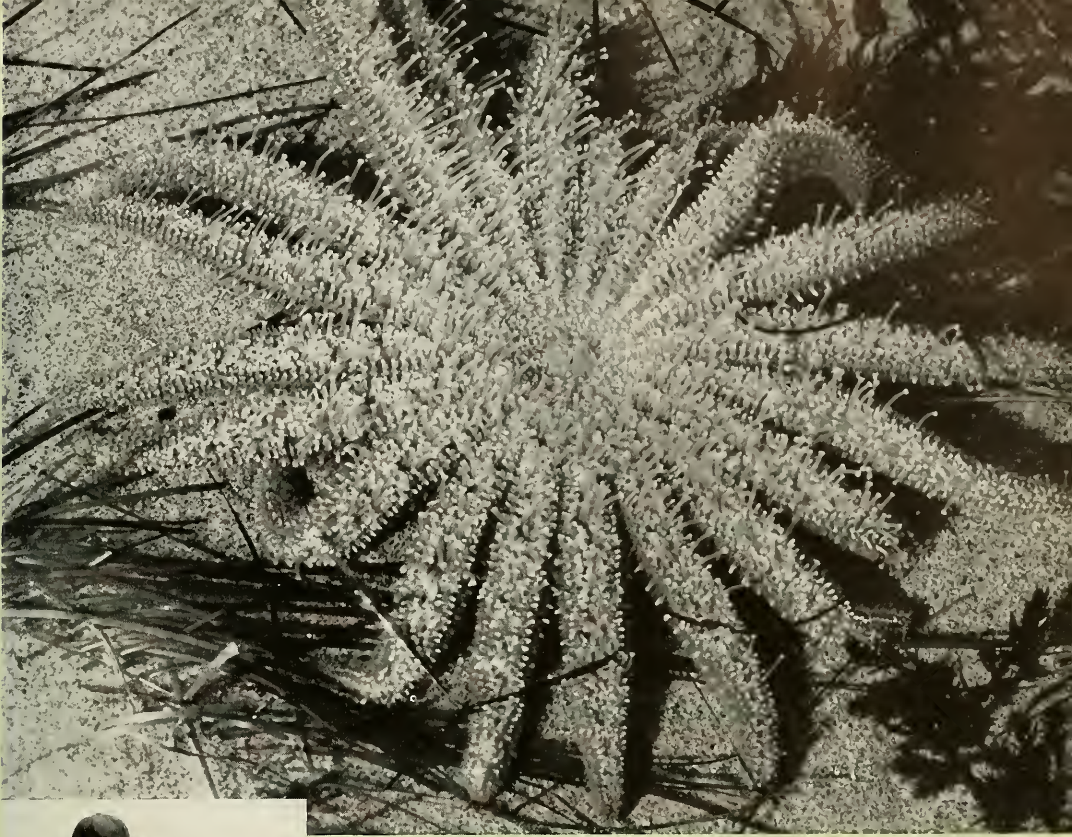
* The motion picture produced during these studies will soon be released by the American Museum of Natural History under the title "Wandorobo."—Ed.



Thousands of tube feet are seen on the bottom of the Sunflower Star (*Pycnopodia helianthoides*), considered the largest living starfish. It reaches a diameter of two feet or more in the North Pacific. At left: a small specimen being examined by two California teachers

A Giant STARFISH

In the hands, this creature is like a wet newspaper, but on the bottom of the ocean it is an "engine of destruction"

By Woody Williams

Photographs by the author

THIS Sunflower Star, or Twenty-rayed Star, *Pycnopodia helianthoides*, is for bulk and size the largest starfish recorded by marine biologists. The North Pacific species attains a diameter of from two to four feet and can weigh in the neighborhood of ten pounds. It is one of the most spectacular of a long array of starfish in which the North Pacific is particularly rich. At least nine other species may attain a diameter of two feet, but they lack the bulk of Pycnopodia.

This unusually active echinoderm ranges into Southern California, but it is not common south of Monterey Bay. In Puget Sound, British Columbia, and Alaska, the creature attains its greatest abundance and size. It is often found at low tide, also as an unwanted invader of crab pots or as a surprise package on the bait of some fishing line.

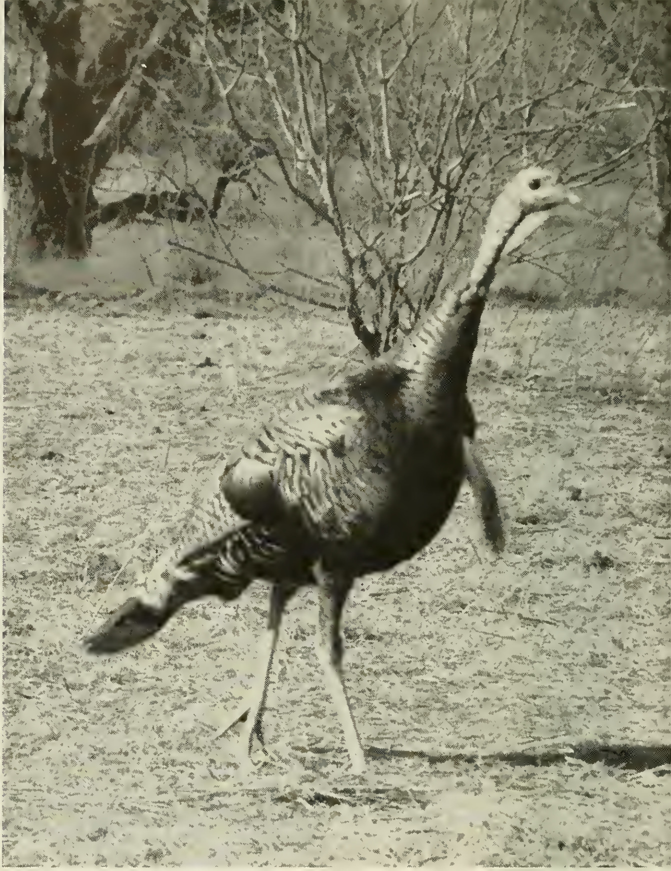
Pycnopodia is an audacious predator that will tackle seemingly impossible foods, such as a giant long-spined sea urchin, *Strongylocentrotus franciscanus*. It can swallow this huge spiny creature whole; and then a day later it will eject the shell cleaned within and the spines disarticulated. On sandy bottoms it will attack the great Moon Snail, *Polinices lewisii*, which is itself a famous devourer of clams.

The Sunflower Star commences life with perhaps only six arms. Additional arms bud in pairs, one from each side of a primary arm. The process of budding continues between the same primary arms, until the adult may boast as many as 24 arms.

On the underside of the arms is an army of tube feet that propel the creature along and aid it in capturing food. Each foot is a hollow tube with a sucker tip that is connected with a centralized plumbing system called a water vascular system. Water enters this system on the top surface at an intake called a "sieve plate." It is then pumped through the system to the tube feet and their suction discs. One Pycnopodia may boast 15,000 such legs.

Pycnopodia, like many other marine giants, is unexpectedly flabby when you remove it from the sea. Mr. Fred Ziesenhenne, Curator of Echinoderms at the Allan Hancock Foundation of the University of Southern California, says it is like picking up a soaked copy of a Sunday newspaper. The creature is apt to shed its arms when roughly handled or thrown into preservative.

Yet in its own environment, Pycnopodia has been characterized as an "engine of destruction." Watch this yellow, orange, red, purple or gray disc, as it cruises rapidly over the rocks searching out its prey, and you will see one of the least helpless of the many creatures that have never acquired a backbone.



▲ BUFF TAIL TIPS distinguish the Rio Grande Turkey from the others

Keep the GOBBLERS Flying

By A. Earl & Grace Jourde

Photographs by the authors

Our symbol of Thanksgiving is facing extermination in Texas—

a bird different from our Eastern and Western turkeys

FOR two years, we had wanted to see and film the last remaining flock of the Rio Grande Turkey. We had learned from the Director of the Dallas Museum of Natural History that A. S. Jackson, biologist with the Texas Game, Fish and Oyster Commission, knew where we might find them. So we went in search of Jackson.

We turned off the highway 185 miles west of Dallas onto the little road that stretches 7 miles across pasture to the headquarters of the ranch where we believed we could find him. The road wound on and on, and the strong, cold March wind, blowing out of the northwest, forced spirals of coolness through the cracks around the car doors and windows. The road seemed longer than we had been told; and the sun, on its unhurried climb into the cloudless blue sky, was more cheerful than warm.

To the north and west were low, blue-shrouded hills behind more blue-shrouded hills. Somewhere this side of those hills flowed a little river known as the Clear Fork of the Brazos. In the bottom lands were the turkeys.

As we passed a shallow tank, a small flock of mallards sprang into the air to circle and alight again as we drove on. A killdeer fussed at us from the muddy banks of the pond. Meadowlarks, disturbed at their breakfast, flew on laboring wings from the roadside grass.

Our pasture road stretched itself across the site of the last stand of the southern buffalo herd to the site of the last stand of the Rio Grande turkey in the United States.

To the north of us a few miles away, leaning against the sky, was the skeleton of old Fort Griffin, looking down upon the stone jail. The jail was the one remaining building of a hell-roaring town of buffalo hunters, freighters, and gunfighters that had sprung up in the shadow of the fort. Here the buffalo made its last stand. The story handed down is that in 1870, buffalo skeletons so covered the country around Fort Griffin that it was dangerous to travel faster than a trot. And today, the only remaining flock of pure-strain Rio Grande turkeys, after much persecution, is making its last stand under the watchful eyes of Watt Matthews, his cowboys, the two State game wardens, and one Federal predatory animal control hunter.

The white dusty path twisted through the squatty mesquite trees, down a steep slope, over a cattleguard, and around the ranch house to the cookhouse. It was a scene Hollywood has tried to duplicate many times—one of the last of the

∨ THESE IMPRESSIVE BIRDS once ranged widely in Texas as well as parts of Mexico. Today, one flock remains

old-time cattle spreads. There was a white-trimmed, rambling red house flanked on the north by the cookhouse, from which the pale blue smoke of mesquite wood was being snatched by the northwest wind. Two bunkhouses combined with this to form a loosely joined T. To the west, behind the corral, stood a large red barn. I eased up on the brake, and we rolled down the hill, swung around the ranch house, and stopped before the cookhouse.

Through the large windows, we saw a man dressed in jeans and a close-fitting blue denim jacket. He got up from a long magazine-littered table, reached for a ten-gallon hat, and started for the door. I got out of the car and walked over to meet him.

He was Watt Matthews, the owner of the ranch, and he invited us in out of the cold. The cook stopped rattling pans on the wood-burning range to bring us large cups of steaming black coffee.

Over our cups we talked of turkeys—where we might find them and how to photograph them. Watt Matthews volunteered to take us to the river bottom and show us where the birds were seen most often in their daily search for food. Then we would go on to see A. S. Jackson and his assistant, whose help we would need in securing our pictures.

Watt and his foreman climbed into a jeep and were soon out of sight as they led the way on a road that twisted through the mesquite. Then, coming out of the trees, we saw the jeep waiting for us. We pulled alongside and looked down into the winter range of the turkeys, the shallow valley of the Clear Fork of the Brazos.

Below us spread the floor of the valley, eaten out of the prairieland by the river. The bottom land was dotted with prickly pear and small mesquites, which blended into a line of tall pecan and cottonwood trees marking the course of the river along the far side of the valley. Watt pointed out a group of nine turkeys feeding below us.

As we stepped from the car to get a better look, the birds saw us and vanished, even though they were a half mile away. Our first turkey lesson had been learned—no movement. We drove down the slope and across the valley to the river. Here we met Jackson and his game warden assistant, Talmadge Palmer, who had been setting up a turkey trap with the aim of moving live birds to other suitable areas. We held a conference with them before driving throughout the turkey range, viewing and discussing possible sites for our needs.

We studied the known feeding sites but discarded them all, either because of bad light conditions, restricted filming area, or poor background. The place we finally selected was a clearing near the river, and the many signs about indicated that it was used by the birds in their daily trips through the river bottom in search of food. We set up our blind in a triangle formed of three hackberry trees and covered it with brush and broomweeds. We then scattered feed over the clearing.

We drove away and selected a place to camp for the night, returning to the blind just before dark. Turkey signs were everywhere. Optimistically we put out more feed so it would not be necessary to show ourselves near the blind after daybreak.

We were up and cooking breakfast by lantern-light in order to be in the blind before dawn. Also with the aid of the lantern, we set up the cameras, tripods, and other accessories in the blind.

The wait for daylight had begun in a below-freezing temperature. The stars slowly faded, and once or twice it seemed that day had come. A cardinal whistled; a fox squirrel in a near-by pecan tree barked; and then there was no doubt that dawn had stepped across the low eastern hills. A few

THE FIRST TURKEYS noticed the photographers half a mile away and took flight. The blind shown under construction in these pictures permitted picture taking at close range minutes later, a gobbler downriver gobbled and was answered by another gobbler from upriver.

The waiting was hard on our straining ears, for we were listening for the sound of rushing wings as the turkeys left the roosts. Finally, faint but still recognizable, came the beat of heavy wings against the air as the big birds flew to the ground. They were down now, but would they find our carefully placed feed? All the worries that beset a photographer paraded before our minds. We rechecked the cameras to make certain the lens caps had been removed and the shutter speeds properly set.

Thirty minutes, forty-five minutes dragged slowly by without sight or sound of the turkeys. Then, suddenly, there they were, silently coming out of the timber, feeding along the edge of the clearing. Eleven birds not over seventy-five yards away were unconcernedly feeding. A squirrel ran out on a dead branch and scolded them. They had found our bait, and with much scratching and scattering of leaves and grass, the birds fed nearer to the center of the clearing and before our blind. A little later a larger flock slipped in from behind the blind to join them, evidently attracted by the sounds of the feeding birds. They were constantly rushing and pecking one another as they fed.

The flock, now numbering 63 birds, was made up of hens and immature gobblers. In the pale gray morning light they appeared much duller in color than the pictures we had seen. Sentinels were constantly on the alert. At no time were all the heads down feeding; always one or two vigilant birds were surveying the surroundings. After fifteen or twenty minutes, the birds drifted away. We had not seen a gobbler strut. Photographically this group was of no consequence; the day was too young and the light too reddish for color work.

The Rio Grande turkey, *Meleagris gallopavo intermedia* Sennett, is a race that differs slightly in coloration from the Eastern Turkey and from the Western or Merriam's Turkey. It was formerly found in southern, south-central, and north-central Texas, in addition to northeastern Coahuila, Nuevo León, and Tamaulipas in Mexico. The tips of the tail feathers in the Rio Grande bird are buff, while those of the Eastern are of a dark chestnut and those of Merriam's Turkey almost white. The body dimensions and the wingspread are virtually the same.

The birds had drifted upriver, and we anxiously settled down for a long wait. Our muscles grew cramped, for we could only move a little at a time. Our conversation, when any was necessary, was in the lowest of whispers.

On whistling wings two mourning doves dropped into the clearing to eat. Some white-crowned sparrows joined the doves. A Carolina wren sang as it searched for food along the trunk of a fallen hackberry tree. With much loud chattering and the scratch of running feet, two fox squirrels played in a near-by pecan tree. Then, among the distant trees, three gobblers fed toward the river. The iridescence of their feathers flashed as they moved from the shadows into the sunlight. But they continued across the river and passed from view beyond the far bank. A bluejay busied itself in a cottonwood while a golden-fronted woodpecker rattled away on a dead limb of a post oak. Noon had come, and we

➤ THE TELEPHOTO MOVIES that were secured would have thrilled any wildlife photographer. The authors called it the most colorful and memorable scene in 20 years of bird watching felt it was time to have some coffee.

After lunch we walked back down the slope, rebaited the clearing, and entered the blind to resume our waiting and watching. The force of the cold wind had decreased. The warm sunshine filtering through the blind helped to chase away some of the chill that had seeped in during the morning watch.

Shortly after two o'clock, three hens strolled into range. Our movie camera whirred and the still camera clicked. At last, we had some turkey pictures; but this was only the beginning. Among the trees a large mixed flock of hens and young gobblers we had been watching evidently heard the feeding hens. With much noise, they rushed in to join them. At close range, the 90-odd feeding turkeys were noisy. To other turkeys, the sound must carry great distances, for soon three old gobblers, in all their splendor and with enormous beards dragging the earth, entered the clearing like monarchs. In perfect unison, the old boys serenely walked to the rim of the feeding flock and fanned out their tail feathers and lowered their wings until they touched the ground. The three gobblers stayed very close together in a straight line. In this formation, they began turning, at the same time ruffling the feathers and vibrating the wings, which made a rustling sound as they brushed against the ground.

Soon two more old gobblers walked into view; then three others entered the stage. Each group stayed aloof, strutting, turning, and wheeling in line, as does a well-trained *corps de ballet*. We saw no fighting among the gobblers.

The gobblers could hardly be called persistent suitors. After a few minutes of strutting, they had not won any brides, and they absently lowered their feathers and began eating. On finishing the food scattered before the blind, the birds drifted away in search of more food, and we packed up and started home. It had been the most colorful and memorable scene we had witnessed in 20 years of bird watching.

Down through the centuries, the Indians of north-central Texas hunted the turkeys. The flocks held their own under these conditions, for the Indians killed only for their simple needs. Then, at the close of the Civil War, a second wave of enemies moved in. These were the buffalo hunters, drawn to the outer fringe of civilization by the great southern herd. These men usually ate the choicest parts of the buffalo, but for variety in diet, they hunted other game, including the turkey as well as the antelope and deer. But the hunting camps followed the great buffalo herd, and as a result, permanent or constant hunting pressure was not maintained against any animal except the buffalo.

The third wave, the cavalry, rode onto the scene and erected a stone fort, Fort Griffin, on a high hill overlooking the river, as a base from which to protect the buffalo hunters and for operating against the Indians. There followed the usual riffraff of the era, and a town sprang up in the valley below the fort. Here was the southern capital of the buffalo hunters—the roughest, toughest, deadliest, meanest, and most lawless town that existed in the most turbulent period of Texas history. People of the town required meat, and market hunting became profitable. Pound for pound, it was cheaper to kill deer and antelope, but turkeys were also killed in what would today be considered large numbers, principally by trapping.

In three years, the buffalo herd had been decimated. The hunters no longer rendezvoused on the banks of the Clear Fork, and the town died as suddenly as it had been born. The turkey, though persecuted throughout this time, still had sufficient numbers to regain a part of its previous population.

The antelope and the deer were almost gone when the rancher, followed by the farmer, settled on the Clear Fork.

Watt, like many other ranchers, closed his ranch to hunting and became interested in protecting wildlife. The flocks on the ranch began increasing. The turkeys were able to cope with and hold their own against their old enemies, the predators. However, a new enemy rode onto the scene—the night hunter, armed with a repeating shotgun and driving a shiny automobile. The kill of one of these hunters in one night would be fifteen to twenty birds from a single roost.

The Texas Game, Fish and Oyster Commission then took up the defense of the turkeys. A biologist and a game warden were stationed on the ranch to study and protect the birds. The State closed the county to turkey hunting, and the Federal Government sent a predatory animal control man, Leonard Royall, into the area. Under such protection and with winter feeding, the turkeys bounded back and became broodstock for transplanting to areas where turkeys had formerly ranged. All interested parties—the biologists, the wardens, the naturalists, the amateur naturalists, and the bird watchers—heaved sighs of relief. The Rio Grande turkey had been saved from destruction.

But now a new and the most formidable enemy has entered the home range. He is not stalking in moccasined feet, riding bareback, or driving a wagon loaded with dried buffalo hides. He is not market hunting for a frontier town or driving a shiny automobile. He flies back and forth, air-mapping the valley of the Clear Fork of the Brazos. This enemy is the Federal Bureau of Reclamation, which is considering the construction of a dam in this vicinity. If the work is begun, the birds will be killed or driven downriver into unprotected areas where they can be hunted until exterminated. With the destruction of their range, the largest gallinaceous bird and one of the most beautiful in America is facing extinction. The Rio Grande turkey is making its last stand.

Of all the curious methods that plants have evolved to reproduce their kind, these volleying spore cases may well astonish the woodland stroller the most

Nature's splash guns

By Harold J. Brodie
Dept. of Botany
Indiana University

Photographs and drawings by the author

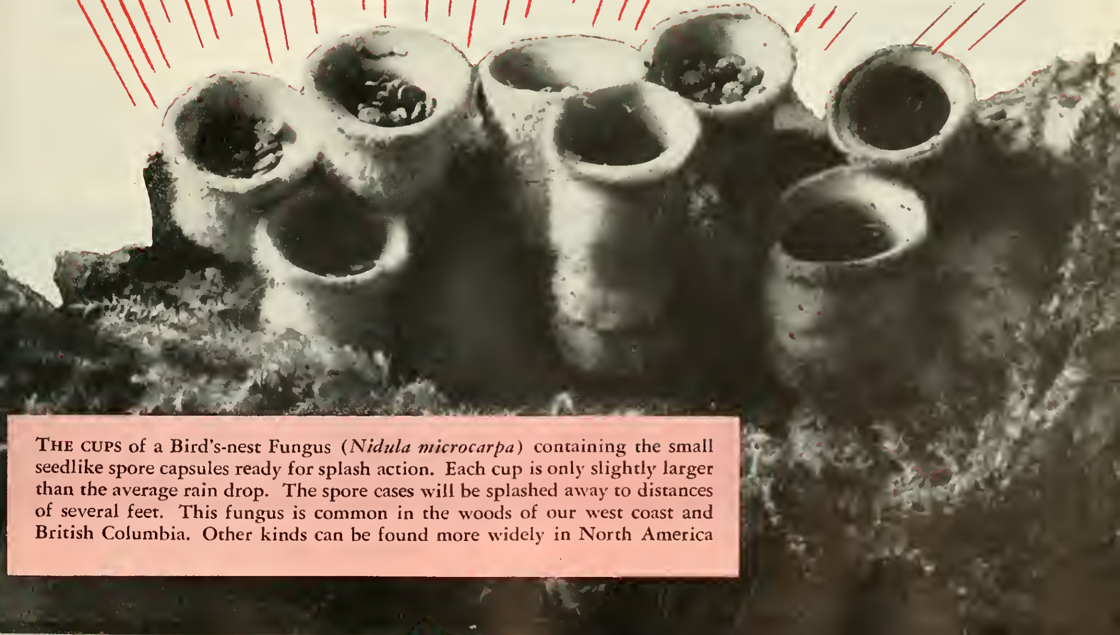
PLOP – plop – plop! The first heavy raindrops break the expectant silence of a sultry summer night. Blessed, we say, is the rain, turning dust to sweet-smelling earth and renewing the green of leaves and moss. In so saying, we recognize the need of living things for water and evaluate the place of rain in the cosmos of nature.

Besides bringing drink to thirsty roots, raindrops are–unseen by most eyes–performing an important service for certain plants, work that is vital in the struggle for survival. Unseen by most except the botanists, and perhaps by only a few of them, this activity of the raindrops is one of the most singular and remarkable occurrences in nature, and until recently it was a mystery.

Anyone inquisitive enough about nature to focus his eyes occasionally on the ground may have seen the beautiful and curious little fungus vases known as Bird's-nest Fungi. Botanists found these objects and wrote about them as early as 1601, but no one recognized them as nature's "splash guns" or observed how they are able to harness the energy of falling raindrops to shoot spores to a distance of several feet.

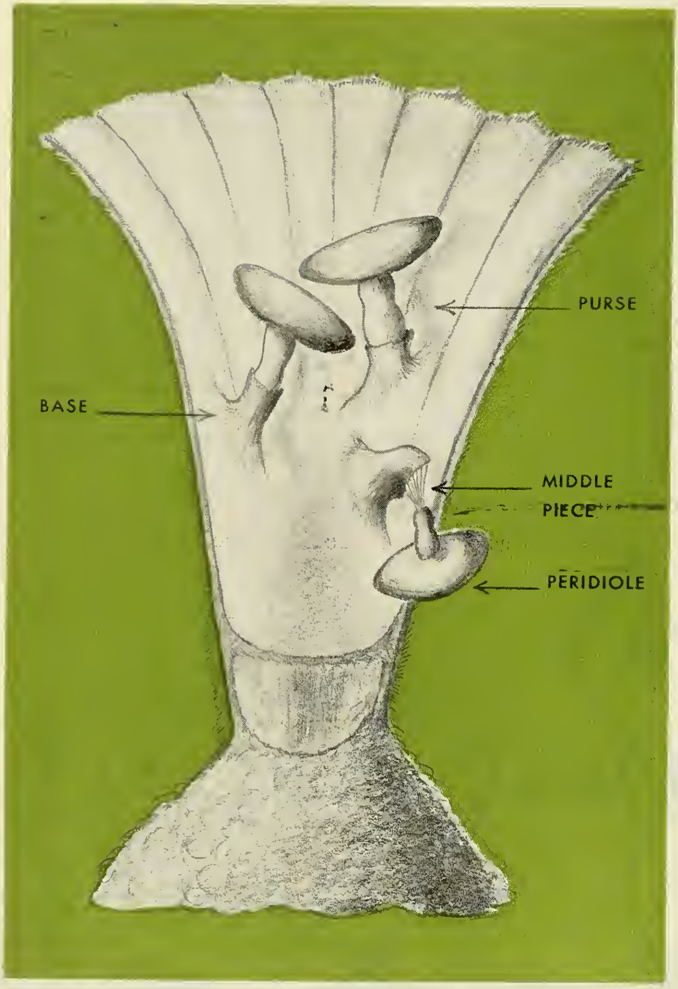
Like all living things, fungi reproduce, and they are remarkable for the many marvelous ways in which they scatter their spores and other reproductive units. Mushrooms, puffballs, earthstars, and other similar growths represent various astonishing methods of accomplishing this. Among them are found explosive mechanisms for shooting spores away, catapults for slinging out balls of spores, and vile odors for attracting insects which will unwittingly carry spores away on their bodies.

No spore-scattering devices are more beautifully simple (or simply beautiful) than the "splash cups" produced by the bird's-nest fungi,

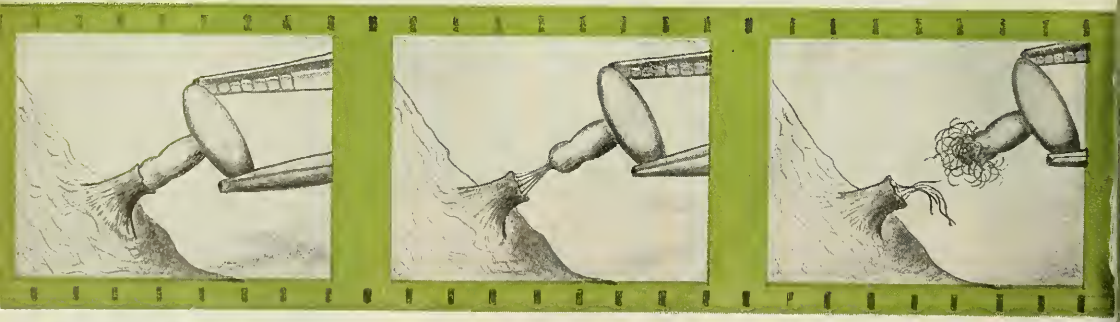


THE CUPS of a Bird's-nest Fungus (*Nidula microcarpa*) containing the small seedlike spore capsules ready for splash action. Each cup is only slightly larger than the average rain drop. The spore cases will be splashed away to distances of several feet. This fungus is common in the woods of our west coast and British Columbia. Other kinds can be found more widely in North America the liverworts, the mosses, and even by certain flowering plants. A glance at the photographs of the symmetrical goblets of the bird's-nest fungi explains their name. Like eggs in a nest, there lie within the little cups about a dozen (often exactly a baker's dozen) small shiny bodies not unlike flattened mustard seeds. One can scarcely blame the botanists of the seventeenth century for mistaking these pills for seeds. We know now that each pill is really a packet of spores. The peridiole, to use its correct name, has a hard outer rind. Within it are thousands of spores, too minute to be seen except with the microscope. Even when this had been discovered, the mystery of the nest and its eggs had not been solved. If the microscopic spores really reproduced the fungus, how did they get out of the peridiole with its hard rind? Furthermore, why were the peridioles contained in such an exquisitely symmetrical cup?

In the middle of the nineteenth century, a few botanists were still curious about the problem. The nest and its eggs were subjected to closer scrutiny, and each peridiole was found to be firmly attached to the inner surface of the cup by a strong cord. This added a further question: How could the peridioles get out of the cup to which they were attached? One botanist declared that perhaps insects ate some



▲ THE BUTTON-LIKE SPORE CASES are attached to the inner wall of the cup by means of a sort of stalk. But a drop of rain is enough to splash them loose. A highly enlarged drawing of a Bird's-nest Fungus



▼ FORCEPS will easily detach the spore case and reveal what happens when the raindrop splashes into the cup. In the third drawing here, it is seen how the bottom part of the "purse" is torn open. The spore case flies out of the cup in this condition peridioles and got the cords of other peridioles tangled around their legs. In this way the peridioles could be carried out of the cups. This was a bad guess, but it was by no means the worst of many more. In time, as is often the way in science, a few pieces were added to the jigsaw puzzle, one by one, until at last the whole picture was complete.

If you are willing to stand outdoors in a pelting rainstorm as one botanist did, you will find that when a heavy raindrop lands in a cup there is a rather violent splash (on a small scale, of course) accompanied by an audible plop. After a few more direct hits, *the cup is empty!* Where are the peridioles? Although you suspect they have been splashed from the cups, surely they cannot have gone far. Indeed, they have. You find them only after a diligent search at a distance of three, four, and even up to seven feet from the little cup. Stranger still, each peridiole has stuck to a leaf or a twig because of a long silken cord, which seems to be wrapped around the twig or entangled among the hairs of the leaf. The fastening is secure; all through the rain and for weeks afterward the peridioles remain where they have landed.

Taking some of the cups inside the laboratory, we proceed to examine them under a microscope. Each shiny wet peridiole can be seen firmly attached to the inner wall of the cup by a short stout stem. The peridiole and its stem resemble a minute mushroom. We grasp the peridiole with forceps and pull at it gently. The stout stem stretches slightly, allowing us to see that it is made up of three parts. There is a kind of base or attachment, then a short tapering cord composed of very fine threads, the middle-piece. This is attached to the bottom of the most solid-looking part, the purse. If the whole object is wet and we continue to pull gently, the bottom of the purse is torn open and a great tangle of threads suddenly appears. It is as though one had a mass of wool tightly packed and concealed in one's closed hand. The hand is opened quickly and—poof—a big jumble of wool pops out.

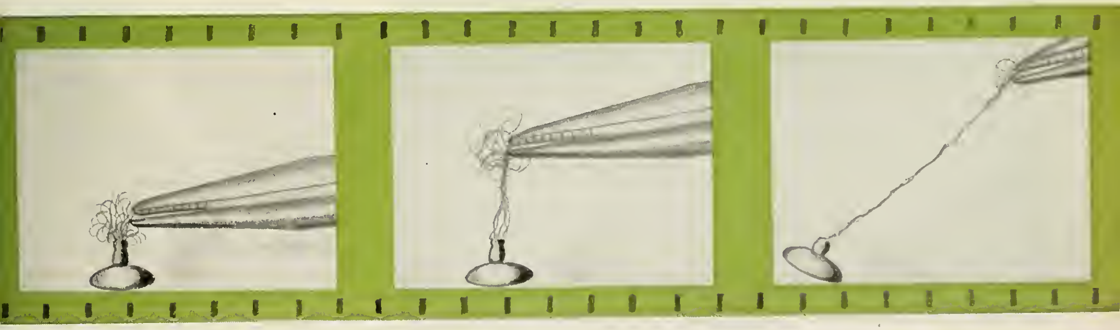
Our curiosity is now thoroughly aroused. We take the thread tangle in our forceps and pull at it again. This time a long fine cord comes out of the purse and unravels miraculously until we have one inch, two inches, three inches, and occasionally more of it. Finally the end is reached, and the peridiole comes, too, and dangles twistingly on the end of the long cord. What a conjurer's trick this is!

▲ When the spore case is thrown out of the cup, the long cord that unravels strikes a leaf and winds around it or becomes attached to the leaf hairs. The spore case may then remain on the leaf until the latter is eaten by a browsing animal, whose digestion will help the process along

The astonishingly long cord that was all wrapped up inside the purse before we began our prodding is called the funicular cord. Under the microscope it looks like a cable of still finer threads twisted spirally around one another, which explains why it easily supports the dangling peridiole. We notice also that the cord is very sticky at the end farthest from the peridiole, where we first saw the sudden expansion of threads.

During a rainstorm, a few drops wet the peridiole attachments, making them pliable. Then the first heavy drop to land squarely in the cup creates a splash. Water is forced outward along the inclined sides of the cup, and there is enough force to jerk at the flat

▼ This sketch by the author shows how the long funicular cord is unraveled. It lies packed away or folded within the stem part until the forceps pull. It then comes out from its casing to perform an important role in the reproductive process



peridiole and to cause the bottom of the purse to be torn. The splash of water causes the peridiole to be thrown out sideways from the cup. It hurtles through the air with the lower end of the purse torn and the funicular cord ready to be unwrapped. Should the peridiole in its flight happen to strike a leaf or a twig (and this does happen frequently), the loose tangle of sticky threads catches on hairs of the leaf or on irregularities on the branch. However, the speed of the peridiole tends to carry it on beyond the point where the threads are caught, and so the cord is pulled out. As soon as the peridiole has literally come to the end of its rope, it is snapped briskly back by the elastic cord, and this causes it to swing around its point of attachment after the manner of action of the South American bola. When the peridiole comes to rest, it is thus firmly attached by the cord being wound around the leaf or branch or sufficiently tangled to hold the peridiole fast. One of the photographs (page 405) shows a peridiole, found after a rainstorm, four feet from the cup from which it had been splashed. Note how the cord is caught among the hairs of the leaf petiole.

Of what advantage, we may ask, is it to the fungus to have its spore cases shot out by rain splashes only to stick to vegetation? Probably what happens is that cows, horses, and other herbivorous animals eat the vegetation and the peridioles with it. One reason for this inference is that certain of the bird's-nest fungi are frequently found growing on masses of horse manure or cow manure in pastures or on manured soil in gardens. When the leaves were eaten, the hard spore case protected the spores but was finally dissolved. The spores were liberated during their free ride and started to grow in the manure, where they eventually developed into more bird's-nest fungi. Other spore cases may blow away on leaves and find a suitable spot on rotting wood or the like.

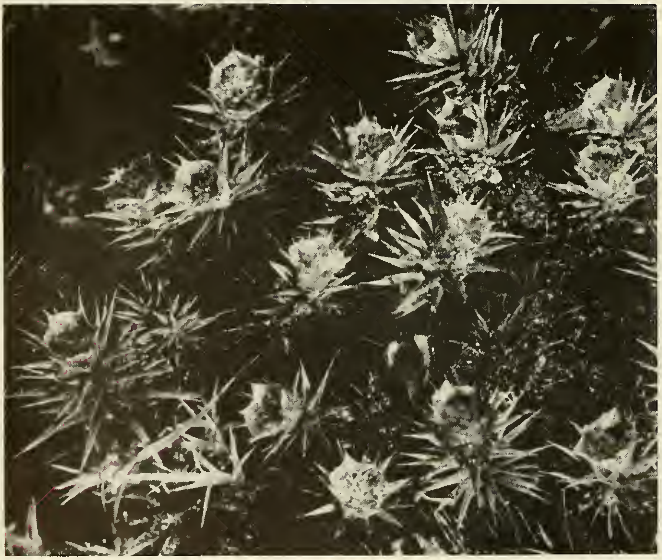
What, you may ask, is the relationship between the perfect vase or funnel shape of the cup and the ability of raindrops to splash peridioles out of it? As one botanist has reported, if a set of clay cups be made of the same size as the fungus cups but with varying slopes to the sides, the cup from which water can be splashed the farthest is the one with the slope equal to that of the fungus cups, which is between 60 and 70 degrees from the horizontal. Evidently this cup best allows the force of a raindrop to be transferred into a lateral thrust.

When the secret of the bird's-nest fungi was exposed, it became obvious that other splash cups might have been overlooked. With this clue and a little thought and experimenting, new light was thrown on a number of tiny cups in the plant world that had been a puzzle or else dismissed without much consideration. In the examples that follow, the splash mechanism is simpler than in the bird's-nest fungi, because the contents of the cups are simply splashed out. The reproductive bodies have no cords to attach them to vegetation, and their journey is over when they have landed.

First, there are splash cups to be found among other kinds of fungi. One is a very tiny fungus that grows on hemlock branches and produces a pink cup, within which lies a ball of fungus tissue that can be splashed out. The ball grows into a new fungus if conditions for growth are good. Another fungus splash cup is developed in summer by a small bracket fungus growing on elm branches. Its spores are not much larger than some large bacteria—three to eight one-thousandths of a millimeter in length. These spores grow in the cups embedded in a sticky material, which swells when wetted. The cup fills with the spores, and these splash out during rainstorms.

Secondly, there are the splash cups produced by green plants. The lowly flat-growing liverwort (*Marchantia*) is one of these found in wet places. On its upper surface it bears large numbers of tiny cups about 3/32 of an inch in diameter. It has been known for a long time that liverwort cups contain gem-

▼ CLOSE-UP of male Haircap Moss (*Polytrichum*). Male reproductive cells ooze into the cup formed by the rosette of stiff leaves. Raindrops then splash them out to land on female plants and bring about fertilization



mae, or buds of green tissue, capable of growing into a new plant if placed on wet soil. But why should the gemmae be held in cups? Obviously because they are splashed out by rain—splashed out, not merely washed out as botanists used to think. Experiments show that gemmae may be thrown two feet from the cups, which is a considerable distance in the world of the minuscule.

Also, there are the cups developed at the tops of male plants or of male shoots of some mosses. In the Pigeon-wheat Moss, *Polytrichum,* the cup is formed by a rosette of special stiff leaves. Deep within the rosettes are organs for producing the sperms or male cells of the moss. When a moss cup gets wet, sperms ooze out of the organs and fill the cup. Then the first sizable raindrop splashes them away. Droplets of sperms can land on female moss plants at some distance from male plants, and fertilization can then take place. In certain mosses, splash cups play a role in the sexual process.

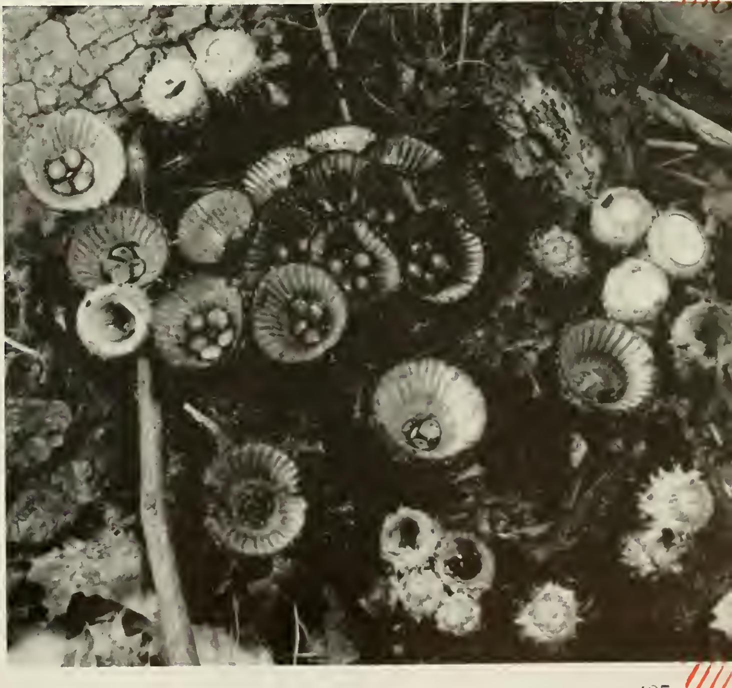
Some flowering plants, too, have "caught on" to the splash trick. One of the Evening Primrose group has seed capsules which remain closed as long as they are dry. They stand upright and seldom, if ever, shed their seeds when dry. But we have only to wet a capsule of *Hartmannia rosea* to see it open very quickly and assume the shape of a cup. If we allow a drop of water to fall from a height of five or six feet into an open wet cup, we observe the splash discharge of the seeds. Likewise, the common Pearlwort (*Sagina decumbens*) has cuplike capsules from which seeds are scattered by splashing action.

Among the many devices developed by plants for accomplishing efficient and wide scattering of their spores and seeds, the splash-gun device is in the spotlight of current investigation. Splash dissemination is probably not a new development among plants, but somehow botanists have paid very little attention to it in the past. When we understand how the splash cups function, it gives us cause to marvel and perhaps to ask how adaptations of this kind have come about.

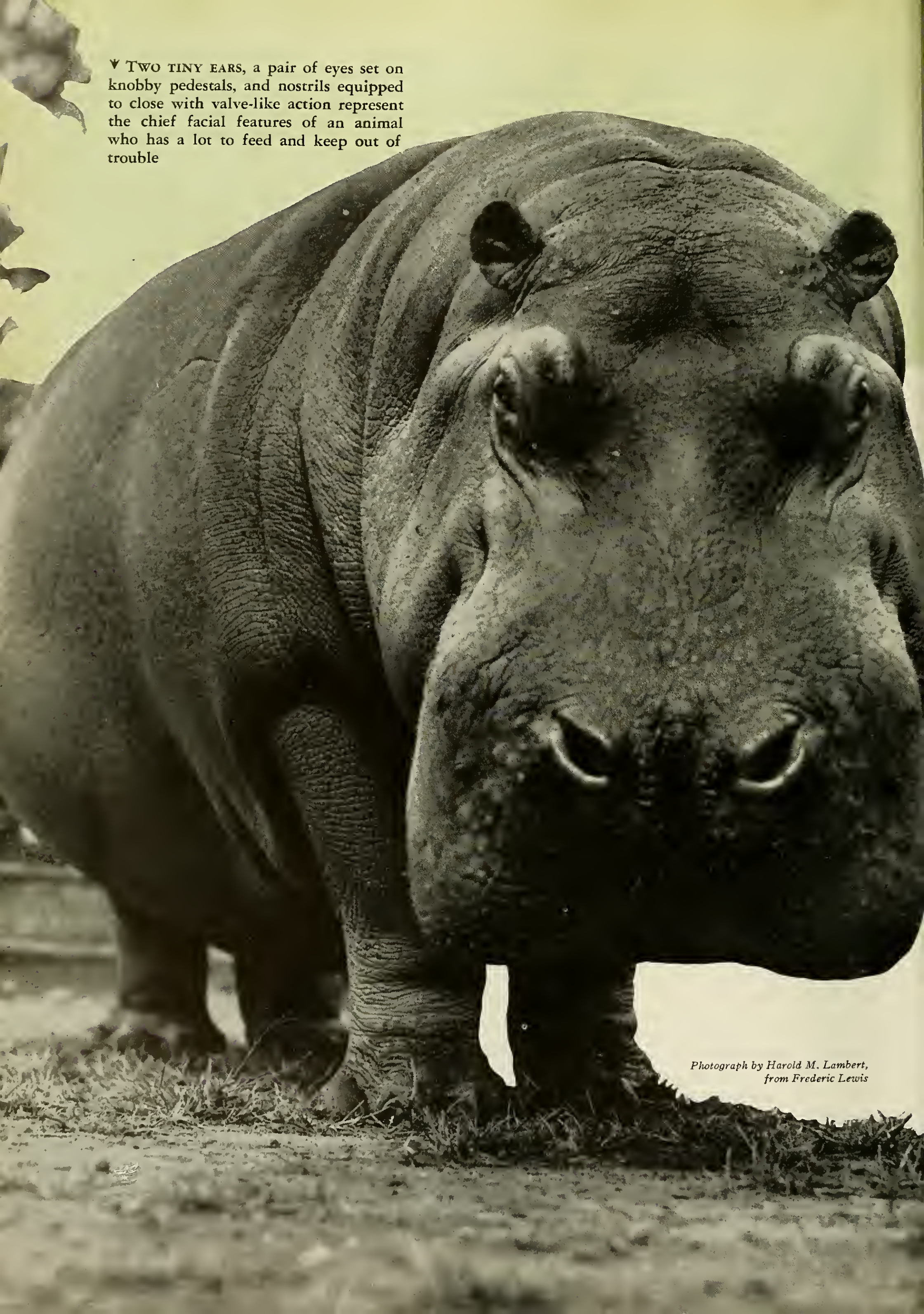
Large raindrops are, on the average about ⅛ inch in diameter. If they have fallen at least 9 feet, they may have a speed of about 20 feet per second. Each raindrop thus represents a considerable amount of potential energy, especially in the microscopic world, and this energy is put to good use when a raindrop falls into the splash cup of a bird's-nest fungus or of any other kind of plant provided with such cups. Highly effective splash cups such as those of the bird's-nest fungi are ¼ inch in diameter at the open mouth. There is, no doubt, a relation between the size of the cup and the size of raindrop that operates best. It can be demonstrated experimentally that raindrops are unsuccessful in throwing granules like spores from very large cups—say for instance, one inch wide.

So, in the splash cups of plants we have another fascinating example of how a close and often complex relationship has come about between a particular vital process and the modification of structure that accomplishes it. The mystery of nature's splash cups has been solved, but for some of us at least, its solution has not dispelled the feeling of awe as we regard the wonders so readily found almost at our own back doorstep. Almost anywhere in the world, in regions of sufficient rainfall, bird's-nest fungi may be found. Look on rotting leaves and twigs in any woodland in late summer or autumn, or in your garden wherever you dug in some manure a year or so ago, or on manure in pastures, and you will run a good chance of seeing these amazing little splash guns in actuality.

▼ SPLASH CUPS of a common Bird's-nest Fungus (*Cyathus striatus*), which grows on rotting leaves and twigs. Some unopened cups are seen at upper right, where the cups are still covered by a white membrane. This later tears open and exposes the shiny pill-like spore cases. These cups are about half an inch in diameter



▼ Two tiny ears, a pair of eyes set on knobby pedestals, and nostrils equipped to close with valve-like action represent the chief facial features of an animal who has a lot to feed and keep out of trouble



Photograph by Harold M. Lambert, from Frederic Lewis

African Water Babies

The hippo is usually a shy child of the water, but when two bulls stage one of their bloody battles, the only similarity is in their thunderous bawls of agony

By Ken Stott, Jr.
General Curator, Zoological Society of San Diego

THE District Commissioner who stood on the veranda of the Grand Hotel had no eyes for beauty. To be perfectly truthful, his vision was a bit foggy. After months of sand and chiggers and smiling native faces that he would never understand, his thoughts were far from Africa, and Khartoum was Piccadilly.

We are told that the night was clear, and the soft wind that crept in from the desert was warm and cloying. A full moon, directly overhead, poured down buckets of silver and lent the landscape a luminescence of its own. The smooth expanse of sand in the distance, the lazy Nile, even the sprawling city itself seemed to glow with the same gentle radiance that characterizes the numerals on a watch dial.

He leaned uncertainly against a pillar, surveying his course: a few steps down the walk to the street, then a half a dozen blocks to the right on Kitchener Avenue, which followed the embankment of the river. The avenue was bordered on each side by densely foliaged *Ficus* trees, which cast black pools of shadow about their bases. He took a couple of trial steps. It was not a long haul by any means, but in his present state, the D.C. viewed the prospective jaunt as he might ordinarily contemplate a month's trek into the blue. Whistling softly, he began to make his way down the avenue.

Storks and herons, roosting in the branches of the trees, squawked sleepily as he passed underneath, and the hordes of bats that hovered over the river filled the air with their soft, scolding noises. Crickets chirped in the gardens, and frogs croaked lustily from the river margins. Otherwise the world seemed static and sleeping. The road ahead was devoid of movement.

Or was it? The D.C. halted abruptly.

A mass of shadow beneath the tree directly ahead seemed somehow to have gained substance. As he watched, it appeared to become three-dimensional and at the same time to sway slightly from side to side. He blinked his eyes and looked again.

The shadow was still there, and what was worse, it was coming toward him. Perspiration gathered on his forehead, for marching down the main boulevard of the Sudan's largest city was a hippopotamus!

The incredulous official gasped in horror. That the D.C. had the D.T.'s he had no doubt; and as quickly as his faltering legs could carry him, he lumbered past the object of his fright and on to his quarters. Khartoum no longer bore any spiritual similarity to Piccadilly, and his evening in retrospect seemed like a nightmare. As he lay in his bed that night, he made a momentous decision: alcoholic beverages were not for him. From now on, it was tea, coffee, and nothing else.

The following day he returned to the Grand Hotel for lunch with a group of his friends. After sitting silently through the meal, only half hearing the conversation of his companions, he decided to admit to his intemperate adventure of the night before. He began rather apologetically but gradually gained spirit as his compatriots showed themselves appreciative and presently hilarious. When he had finished, the fellow who sat nearest him thumped him heartily on the back.

"Poor old Colonel," his friend commiserated, "and you thought you were seeing things."

The D.C. sat upright in his chair, his eyes bulging. "What do you mean 'thought I was seeing things'?"

His friends led him from the dining room and out of the hotel to the street. They stopped in the shade of a tree and pointed to the ground beneath their feet. A slight depression along the roadside had accumulated a thin film of soil, and there, clearly defined in the mud, was a series of giant, spreading footsteps—irrefutable evidence that Kitchener Avenue had played host to a most remarkable nocturnal visitor. The visit of the hippo had been a chief topic of conversation all morning long—and has been ever since.

This incident occurred roughly five years ago, and so far as I know, it is the most recent report of a hippopotamus in the vicinity of Khartoum.

A few years ago, the hippo was common in the area, and it formerly occurred far to the north of Khartoum, on into Egypt and even to the very mouth of the Nile. The last recorded specimen in the Nile Delta is one that was killed near Damietta about 1815. Now the hippo is absent, or nearly so, north of where the White meets the Blue Nile at Khartoum.

Formerly the hippopotamus inhabited most of Africa's rivers, lakes, and even coastal estuaries, but it has since disappeared from the regions that are now under cultivation. Its persecution, though not always justified, is in part understandable, for the hippo has a predilection for native crops.

During the daylight hours, the hippopotamus (or "river-horse," as the Greek term may be translated) spends most of its time in the water or basking in the sun on sand spits. But with the coming of night, it grows more venturesome and, like the one the D.C. encountered in Khartoum, goes for a stroll along the riverbank in search of land food to supplement the aquatic plants upon which it also feeds. Sometimes these nocturnal wanderings are surprisingly extensive; at night, hippos have been seen miles from the nearest water. In uninhabited areas, they must be content with natural vegetation, and frequently this is meager; but a cornfield, properly irrigated and cultivated, is an entirely different matter.

The hippo can put away an impressive amount of fodder, and this alone is sufficient to make it unpopular with the natives whose fields it invades. But in addition, its tremendous bulk accounts for the destruction of an equal number of plants that are crushed underfoot so thoroughly that they are of little use to either the hippo or the farmer.

When surprised by natives, hippos on land can prove highly dangerous. Generally, they are interested only in escape. But in their panic, they are just as apt to flee toward a human antagonist as away, and unless the bystander is quick on his feet, he is liable to be mowed down on the spot. Actual deaths from hippos, however, are comparatively rare, and the native's real cause for complaint is crop devastation.

In some areas, the hippo has been the object of relentless killing campaigns and has vanished with the advance of civilization. The hippo's flesh is relished by certain of the African tribes, and its hide is coveted for the making of leather whips. Even its curling lower tusks, which in some specimens reach a length of nearly four feet, have their value to man as ivory. With as many strikes as these against the animal, there is considerable cause for wonder that the hippo survives at all.

My own introduction to the hippopotamus took place under somewhat pleasanter circumstances than the D.C.'s. It occurred to the south of Khartoum, near Kosti on the White Nile. I was traveling upriver aboard the "Rejaf," a flat-bottomed stern-wheeler, and the animal in question was quite where it should have been—in the Nile.

I sat in a deck chair, alternately observing birdlife through binoculars and wiping perspiration from my forehead so that I might continue observing birdlife through binoculars. Files of sacred ibis flew by, their white wings flashing against the sky, and flocks of ducks and geese swarmed up like giant mosquitoes from the reeds along the riverbanks.

The land immediately bordering the river was parklike: first a dark green wall of papyrus, then a broad

➤ The Sabi River in Kruger National Park was at an all-time low at this time, permitting an unusual view of the animals, which could not submerge

Ken Stott, Jr. photo

band of lush, even-topped marsh grasses, which suggested well-tended lawns; and growing from them here and there were flat-crowned acacia trees and clumps of many-branched doum palms. Beyond lay the gray scrub growth of the desert.

The Nile ahead and behind was smooth, shallow, and murky. At this point it was wide, and the serene surface of the water gave no indication of the direction of its current. Only when a floating islet of papyrus or an occasional log hurried past was the strength and constancy of the current apparent. I was half asleep in the heat of the day when one such half-submerged log began to wiggle its ears. Alice, I'm convinced, was no more surprised when the white rabbit removed a watch from its waistcoat pocket.

Ears were not the only noteworthy feature of the log under observation. It had, as well, a pair of bulbous, red-rimmed eyes that suggested perpetual alarm. A foot or so in front of these rose two shiny, blackish mounds, in each of which was set a flaring pink nostril. Suddenly the nostrils flared even more widely than before, and in an inkling they snapped shut so tightly that no vestige of the pink lining remained visible. Then, with ears folded back, the log submerged completely, leaving only a series of ever-expanding, concentric circles on the surface of the water to mark its passing.

Thus, in a flash, I met the hippo in its stronghold. An inconsequential introduction it was—so brief and incomplete a view of so great a monster—yet I knew it to be typical. Many times as I had sat by the hippo tanks in the San Diego Zoo, there were only these same unrevealing features protruding above the surface to indicate the presence of one of the three largest land animals: two tiny, round ears, two eyes set in their knobby pedestals, and two nostrils whose valvelike action equipped their bearer well for his semi-aquatic existence.

Here in the wild, I knew I stood little chance of seeing this particular fellow again, for by the time he emerged once more, we would be well along our way. I have read that when the occasion demands, a hippo can remain underwater for as long as nine minutes; in the zoo, however, the average period between breathing spells is only three or four minutes. This submerging and surfacing continues even as the hippo sleeps, for the action is as involuntary as breathing itself. It is governed, in part at least, by the proportion of carbon dioxide in the hippo's blood stream. When the CO_2 in the blood reaches a certain threshold, the animal automatically surfaces to exchange a stale load of air for a fresh batch and then submerges again.

During the afternoon of my first hippo encounter, the "Rejaf" churned past several more, each of which reacted similarly—a few moments of distrustful observation, then a swift intake of air and the inevitable disappearing act. On the ensuing day, the interval between hippos grew shorter, and with the passing of each successive mile on the trip south toward the upper reaches of the Nile, they became more and more abundant. Now instead of seeing single specimens, we came upon herds.

There were droves of ponderous, frolicsome cow hippos that bobbed and lolled in the water like human vacationers at a public plunge. They rolled languidly, lunged through the water with gay abandon, or roughly nudged one another with their great broad snouts.

Sporadic snorts seemed to be the hippo equivalent of girlish laughter. Once we came upon a cow standing ankle-deep in a shallow inlet. She watched us momentarily, half in fright, half in a sort of awkward embarrassment. Then she broke into a hysterical gallop, throwing her head wildly from side to side. Water splashed in every direction, and when at last she reached the edge of the channel, she plunged headlong into the depths. She vanished instantaneously and left in her wake a geyser of water and foam.

The bulls, magnificent despite their graceless proportions, seemed somehow more dignified than the cows. It was almost as if they considered such playful, undisciplined demeanor beneath them.

Their bodies were branded with battle scars, long furrows of gray or fresher incisions of angry red. Hippo bulls are savage fighters among themselves, and in their gleaming ivory tusks they have an excellent weapon, guaranteed to gouge or slash even the toughest hide. Their bloody battles occur chiefly at night, and the accompanying vociferations can be heard for miles around. Each contestant bellows constantly at the top of his lungs, and, when any injury is inflicted upon him, he bawls in thunderous agony. Hippo combats sometimes terminate fatally; more often, however, they result in the exile of the vanquished—either a young animal not yet powerful enough to hold his own or a tired old warrior whose prowess is on the downgrade. Sometimes an older male develops a bully complex and delights in attacking the smaller, weaker bulls without provocation. One by one he may slaughter them wantonly or, after severely wounding them, drive them from the herd.

Occasionally such an outcast, bleeding and pain-maddened, seeks refuge on shore and vents his spleen on anything he encounters. One mutilated bull charged into a herd of domestic cattle and ran them down one after another until his ravages were cut short by native spears.

As the "Rejaf" forced its way

▲ **The hippo** excels in cavernous yawns of record expanse

Photograph by Harold M. Lambert, from Frederic Lewis

Photograph by G. E. Kirkpatrick, Zoological Society of San Diego

▲ THE MOTHER lavishes affectionate care on her young, which is shoatish and winsome

upstream, I saw no evidence of this harsher, bellicose side to the hippo's character. It seemed difficult to picture the animal as anything but playful in a clumsy, buffoonish manner or just plain phlegmatic, the latter state being accentuated by cavernous yawns of record duration and oral expanse. They seemed a happy, peace-loving lot, these monstrous river dwellers, and the affection they lavished upon their young only added to the impression.

The babies were tiny, wrinkled creatures, which had a winsome attractiveness every bit as moving as that of domestic puppies and kittens. Infancy seems to be a common denominator that lends even the most grotesque of nature's creations a beauty that cannot fail to appeal. Somehow, the hippo's distant kinship to the swine was more evident in the toylike young than in the adults. They had a distinctly shoatish quality about them.

It was not uncommon to see an infant hippo floating beside its mother with its head stretched out and resting on the side of her neck. Although I have never seen it, I am told that it is not unusual for a baby to climb from the water and lie on its mother's back as she swims.

Hippo babies begin their lives as strictly aquatic animals. They are born in the water and remain there for some days. In the zoo, we have constructed a shallow nursery pool inside the hippo house, where the mother and her offspring are afforded complete privacy from the public. The baby is born in the tank and nurses there, in the water, throughout its infancy. Even after the baby joins its mother on her daily wanderings about the enclosure, the two of them return to the tank at frequent intervals so that the infant can nurse.

A hippo baby at birth weighs between 75 and 90 pounds—a far cry from the 3 or 4 tons it may eventually accumulate! The gestation period is relatively short for so large an animal—8½ months as against 18 to 22 months required for the production of an elephant child.

The gestation period for the pigmy hippo of Liberia and Sierra Leone is only a few days less than that of its larger cousin, yet the end result is not so impressive. An adult pigmy hippo weighs no more than 600 pounds and usually around 500, and the babies are small enough to fit comfortably into a dishpan! Despite a similarity in appearance, the pigmy differs somewhat in its habits from the larger and more widely distributed species. It probably passes more of its time out of the water.

It is nongregarious, living either alone or in pairs, and it spends far less of its time in the water. It inhabits dense swampy forests, which it explores by night. During the day, it sleeps in thickets or in hollows in riverbanks. Shy and wary, it is seldom observed in the wild state and very rarely captured. It was not until 1912 that the first living specimens were exhibited in a zoo; and these, captured in pits in Liberia, were obtained by Hagenbeck, for the New York Zoological Park.

The "common" hippo (as the larger species is usually called) is far from common in many areas, but it is still abundant in some parts of Africa. Probably the greatest concentration is that west of Murchison Falls on the Victoria Nile in Uganda, where there are literally thousands of the beasts. But the herd that is best known in Africa and the one visited by the greatest number of people is a small group that dwells in a pool in the Sabi River in Kruger National Park.

At the time I visited Kruger Park, the trip from the parking area to the location of the hippo herd was a short one, perhaps a quarter of a mile. We followed a narrow, sandy path which wound through

Continued on page 432

a scientific Journe

Part II

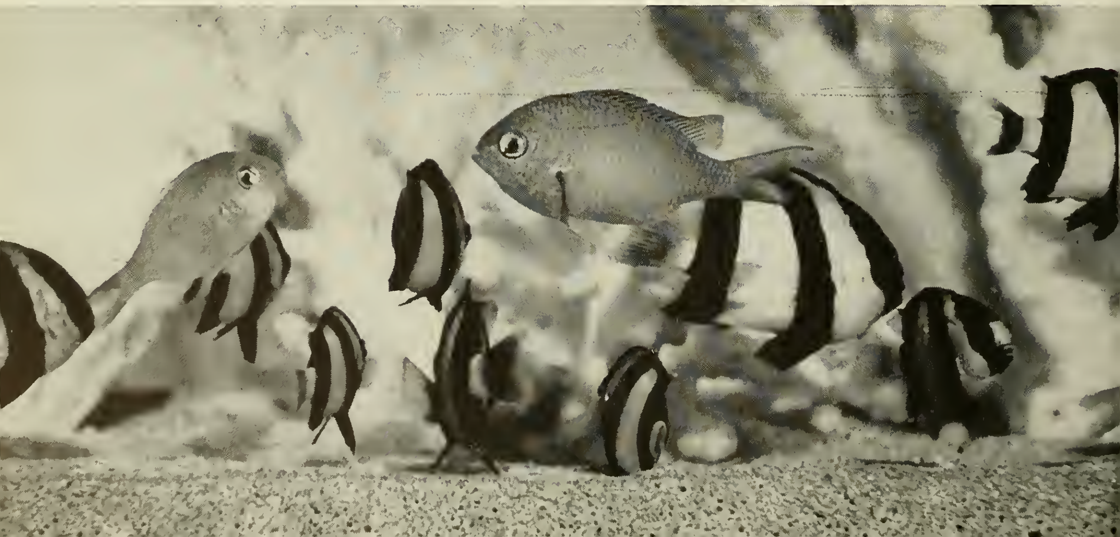
LIFE at the Marine Biological Station of Ghardaqa on the Red Sea coast of Egypt was always fascinating and enjoyable. But it was a special treat to have my husband there for a few weeks' visit and to share some of the exciting life I was leading. Like most people who come to swim in strange marine waters, Ilias wanted to know something about the local sharks.

Most of the sharks you are apt to meet around a coral reef in the Red Sea are not dangerous. Their eyesight is very poor, and even if they are able to see you, the chances are that they will swim away. I had told Ilias this.

We were spending a day spearfishing and collecting at "Sharks Bay," a beautiful spot some 50 miles south of Ghardaqa. Ilias had

▲ Dr. Clark, about to lower herself off the end of the boat in the Red Sea with a speargun for shooting specimens under water. The wooden-handled harpoon (*right*) is kept handy for slower fishes

▼ Two types of Damsel Fishes common about Ghardaqa. The plain one is brilliant emerald green, almost neon. The other is black and white striped. Both form large schools and are sometimes caught by shaking a chunk of coral over a net



yet to see a shark face to face and was becoming almost impatient. "I thought you said we'd see sharks out here," he commented after we had been in the water about half an hour.

But it was a good place for spear-fishing, and we caught squirrelfish, surgeonfish, a sting ray, a scorpion fish, a huge porcupine fish, and others. We were a good distance apart sometime later when a shark about four and a half feet long came suddenly from behind a wall of coral and swam past me.

It was a specimen of *Triaenodon obesus* (meaning "the three-cuspid-toothed fat one"), named by Ruppell, who first described this shark from the Red Sea in 1835. It may be classed in the family of what are popularly known as "true sharks" (Carcharhinidae). This is the only group of fishes with a nictitating membrane in the eye and bladelike teeth, enabling them to wink at you and then take off your foot in the same moment. This particular species — blunt-nosed, small-toothed, and among the less streamlined of the carcharhinids—seldom exceeds six feet and is generally considered harmless. It is easily recognized from a distance by the white tips on its dorsal and caudal fins.

"There's a small white-tipped shark coming your way," I called out to my husband. That should satisfy him, I thought. With underwater magnification, it would seem a good six feet in length.

He peered around in anticipation, at the same time backing toward the shallow part of the reef.

"I see it," Ilias yelled back, and then he added, "There are two of them."

He started swimming faster, and then, as I watched, he stopped, looked underwater through his face mask, and disappeared from the surface.

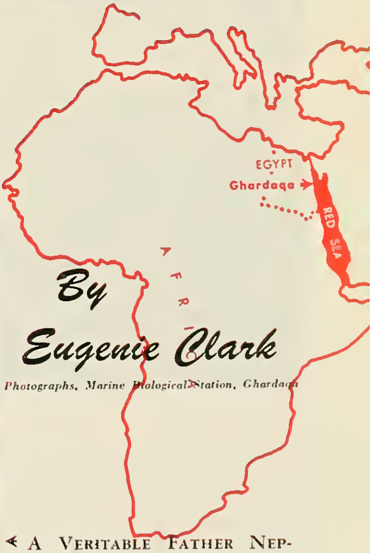
I caught my breath and wondered how big the second shark was and whether it was the same harmless kind. Suppose it were a hammerhead or a tiger shark. In the Station's museum there were giant skins of these rarer species, which had been obtained locally. The old head sailor, with little prompting, would tell you in his Upper Egyptian dialect, supplemented by dramatic gesticulations, about the time a hammerhead attacked him while he was standing in only a few feet of water, ad-

Proving that adventure is where the sea fans wave and that the local Izaac Waltons know more about where to find that most desirable fish than the most highly trained scientist

to The Red Sea

By Eugenie Clark

Photographs, Marine Biological Station, Ghardaqa



◂ A VERITABLE FATHER NEPTUNE: Dr. Gohar, Director of the Station, with the author. She has just speared a poisonous but beautiful blue spotted sting ray. Both wear typical spearfishing outfits with face masks and air-tubes equipped with a rubber ball that closes the tube during dives justing a reef marker on the coral next to the Station. It was a rare incident, which took place a long time ago, but the deep scars on the calves of his legs attested to the ferocity of the attack.

I estimated the seconds. If Ilias had dived of his own accord, he should have come up for air by now. His head finally broke the surface, and he stood up on the shallow reef. "Look, I speared a fish," he said triumphantly, as he waved his spear with a parrot fish on the end.

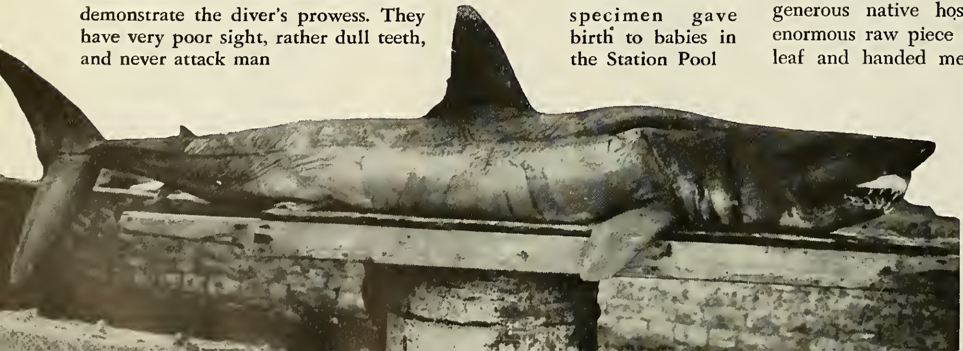
So everything turned out all right. But don't conclude that spear-fishermen are fearless of sharks. Only a few days later a large fellow about eight feet long appeared suddenly from beneath us, and in all due respect, we leaped into our handy canoe, almost overturning it. It was a more streamlined species, and although the dark edges of its fins suggested it was one of the less harmful species, we were satisfied to forego further identification.

The most savage-looking shark in the Red Sea is undoubtedly the Mako. We were glad to know it only from the specimens in the Marine Station's museum. A ten-foot female had been captured alive some time ago. Before she died, she gave birth to six babies. Even pickled in formalin, these chubby little fellows—with their characteristic sharp noses, bright eyes, and symmetrically crescent unshark-like tail—looked cute. But their mama! Her monstrous set of teeth, each like an elongated curved spearhead, dwarfed those on the mounted twelve-foot tiger shark. Because of its spectacular habit of leaping out of the water, particularly when hooked, the Mako is a popular game fish. Its streamlined body and the fact that it is known to feed occasionally on the swift swordfish, are evidences that this is one of the fastest sharks known.

In Fars el Bahr, the largest fish market in Suez, I saw the head of a large Mako on the counter. When I inquired about the rest of the body, I learned that it had been "sold out." It was somewhat surprising to find that sharks were eaten at Suez, for at Ghardaqa they were never eaten, and even Dr. Gohar, with his gastronomical curiosity, had never tried one.

My first experience eating shark had been in Kayangle, a far-off little island in Micronesia. As soon as it stopped kicking around enough to allow itself to be properly sliced, the shark was cut up in native culinary fashion, and my generous native host placed an enormous raw piece on a coconut leaf and handed me my supper.

▲ THE AUTHOR'S HUSBAND, standing in a pool with some large but harmless nurse sharks. This is the type of shark often used in underwater movies to demonstrate the diver's prowess. They have very poor sight, rather dull teeth, and never attack man



▼ THE MAKO SHARK is not to be trifled with. This specimen gave birth to babies in the Station Pool

▲ **SOLIMAN THE SAILOR**, holding a large Shovel-nosed Skate or "guitar fish." This harmless relative of the sharks is frequently caught on the sandy bottom in nets

▲ **DR. CLARK** showing a large, rare trigger fish to Jefferson Caffery, U.S. Ambassador to Egypt: a scene in the author's laboratory at Ghardaqa

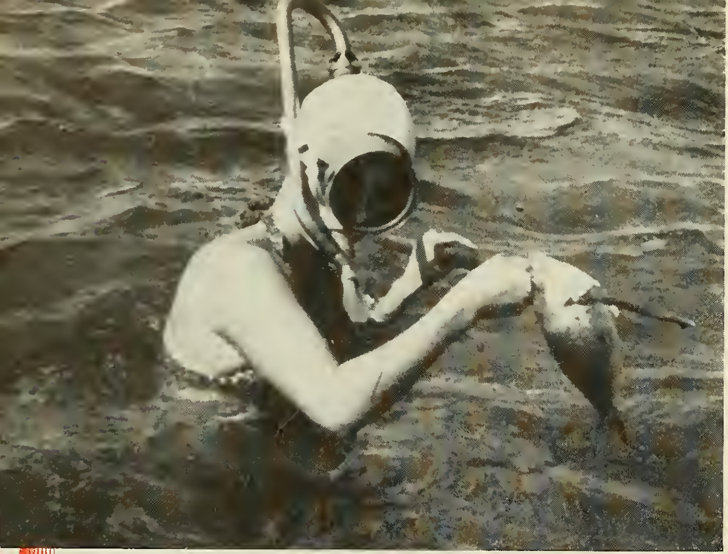
The odor bothered me somewhat, but I have never forgotten my surprise at the tender and pleasant-tasting white meat, which I finished with no great struggle. I made a mental note to try it properly cooked someday. What better opportunity than at Ghardaqa?

Dr. Gohar consented willingly, and Mohammed the cook, less willingly, prepared one of the tastiest dishes I have ever had—steamed shark and onions with tomato sauce. The shark was as delicious as the tenderest breast of chicken and had the advantage of having no bones to bother either cook or gourmet. Mohammed had washed it well before cooking, and although it had been alive that same morning, it had no offensive odor. Thus we had a new addition to our somewhat limited menu at Ghardaqa.

The most effortless way to catch a prized food fish I ever witnessed was after a freak accident at Ghardaqa. The Rector of Farouk University, Mustafa Amer Bey, and his family had just arrived for a short visit, and Dr. Gohar was anxious to impress them with the wonders to be seen at his Marine Station.

We had all just sat down on the Director's back porch overlooking the sea and the little pier with its laboratories. Then, just when the audience was all seated, as though a cue had been given, action started in the shallow water before us. The surface, calm a few seconds before, began to churn. Thousands of tiny silver fish flew through the air, and the backs and tails of over a hundred large jack-fish could be seen as their powerful bodies slashed about. The large fish were trying vainly to free themselves from water shallower than their bodies, into which they had heedlessly chased their small prey. A few of the jacks actually flapped out onto the beach. Mohammed and the houseboy ran out and picked them up by the tails. The Rector's two young sons also leaped from their seats and ran to the beach, and we all watched the spectacle, pop-eyed. Yes, Amer Bey and his family were impressed by the Red Sea.

While the Marine Biological Station cannot promise a show like that for its visitors every day, it has a store of surprises for the specialist as well as the layman. Its modest museum, under the constant interest of the Director, has accumulated what is undoubtedly the world's finest collection of animals and plants found in the Red Sea. Dr. Gohar's specialty is corals. The magnificently prepared specimens of his huge assortment bring "oh's" and "ah's" from his lady visitors, who always want to take a small piece home for a table centerpiece or other decoration; and they are always obliged. But this is only a small part of the Station's collection. Also included are eight specimens of the "extinct" dugong,



mounted shore birds that cause visiting ornithologists to gape in awe, one of the largest sea turtles ever found in the Red Sea, invertebrates too numerous to mention, sea plants, and even a collection of the local desert reptiles and mammals.

You may not find everything catalogued as precisely as in some of our city museums, but you cannot help wonder how Dr. Gohar, with his inadequate scientific assistance, has amassed such a collection.

To one interested in fishes, looking through his museum is like discovering hidden treasure. In the first few days of examining the plectognath collection (the group

▲ COMING OUT of the Red Sea with a parrot fish on the spear

➤ THE AUTHOR and native assistants collecting fishes after poisoning a tide pool on the Red Sea coast. Many small reef fishes can be caught in this way, especially eels

◄ EUGENIE CLARK, holding a Scorpion or Chicken Fish just speared in Sharks Bay. It has a row of poisonous spines in the attenuated feather-like filaments in its dorsal fin of fishes in which I am most interested), I found two amazing new species of filefishes. They belonged to rare genera that have baffled specialists trying to trace the relationships between filefishes and puffer fishes. For here were filefishes that blow up, using the same mechanism as the puffer fishes do. These genera had never before been known to occur in the Red Sea or even in the Western Indian Ocean, so the two specimens I mention extended their range remarkably.

A gigantic sting ray, like a big brown pancake with a whip from one end, hangs on the museum wall, waiting to be described to science for the first time. There are over 60 huge mounted skins of 16 different species of sharks, 10 rays, and 3 skates (including the formidable looking sawfish), and several hundred smaller skins (many colored) of the multivarious reef fishes. The talented artist and taxidermist, Moawad Mohsen, has also made numerous life paintings, which record the colors, behavior, and other characteristics of a specialized marine fauna of much importance in our understanding of the intricacies of tropical sea life.

The Red Sea is unique among seas. It is the northwest extreme, the upturned tail, of the great Indo-Pacific tropical waters. It differs sharply from the Mediterranean, from which it was once separated, though now thinly connected by the Suez Canal. This artificial canal provides a "leak," and consequently there has been started a small exchange of the most adaptable species between the vastly different conditions that exist in the temperate Mediterranean and tropical Red Sea.

If you compare a typical sample of fishes from the Mediterranean with a sample from the Red Sea, the most casual eye can tell there is a great difference between them, even though less than 100 miles separates the two bodies of water. But compare a sample of fishes from Ghardaqa with a sample from Hawaii—12,000 miles away (as the bee flies, not as the fish swims!), and you will find such similarities that it needs expert scrutiny to detect the real differences. For the same blenny that skips around the tide pools of Hawaii does the same along the Red Sea. The commonest poisonous puffer fish in Hawaii offers the same danger in the Red Sea.

However, close study does reveal that evolutionary processes are causing specializations in the comparatively isolated life in this Sea. These specializations have taken place over the many thousands of years the Red Sea has been almost cut off from its mother, the Indian Ocean, the only apron string being the Strait of Bab el Mandeb, a shallow sill at the southern tip of the Red Sea only 100 meters deep.

Probably nearly ten per cent of the species of fish found in the Red Sea are not found elsewhere. Another large per cent show intermediate stages in the evolution of Indo-Pacific forms into those peculiar to the Red Sea and its special ecological conditions. Located in the midst of an arid climate, where the evaporation from the water surface greatly exceeds the small precipitation, it is a great "salt basin" of high temperature and high salinity. Unlike most seas, it has no rivers flowing into it. Although the general depth outside the reef-bound coastal waters is about 700 meters, the jagged depths may sink to over 2000 meters.

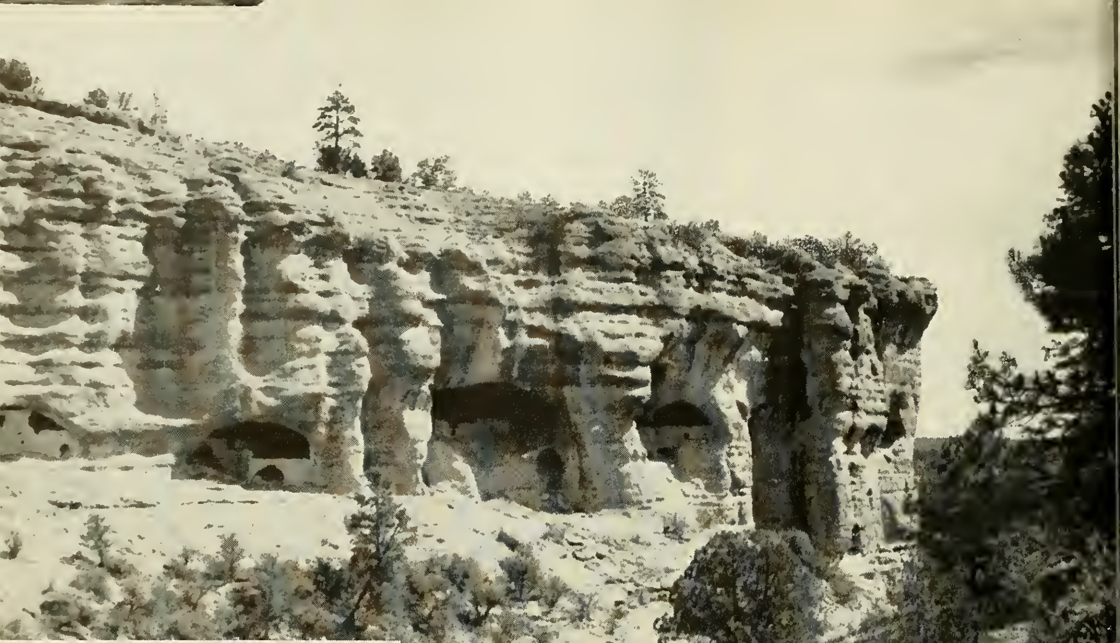
It is a challenge to all marine biologists to study the dynamic processes taking place in this sea, with its conveniently limited fauna and peculiar ecology. It has been relatively neglected by modern field biologists. The Marine Biological Station at Ghardaqa, which welcomes scientists from all over the world, offers these opportunities.

The sailors, fishermen, and "lab" assistants with whom you will work closely probably won't speak your language. They speak a dialect of Arabic sometimes referred to as "Upper Egyptian." They come from a mixture of backgrounds: fishermen and farmers from the Nile valley, Negroes from the Sudan, Arabs from the desert. But it is easy to get along with them if you are interested.

There are a number of disadvantages to traveling as a tourist, but a fish scientist in a strange land has everything in his favor. There is a natural urge in all peoples to help out a stranger—whether it springs from a sincere desire to be of service, an impulse to show off, or merely curiosity to get one's nose in closer. And when you're a stranger who has come to hunt and study fishes—whether you stop for a day on a remote South Sea island (where you don't know a word of the local tongue) or for a year at the end of the desert (where you gradually learn to stumble through sentences)—you will be surprised at the eagerness of the local Izaak Waltons to help you get the fish you want most.

You may not receive a warm response if you ask a rich friend to help you obtain money, but ask a strange fisherman to help you find a specific fish (the harder and rarer the better), and you will immediately get his interest and eventually his wholehearted help. You don't have to know his language; just draw a picture of the fish, gesticulate for his help, and let him do the rest. In doing so, you have told him three important things: (1) that you have not just come to stare at him and his people but have a specific interest in common with his, (2) that you respect his judgment and recognize his superior knowledge of local conditions (and a native fisherman knows more about his water than the most highly trained ichthyologist), and (3) that you trust him.

Sharing the fun of fishing turns strangers into friends in a few hours. Whether you sit with unknown natives in their boat and fish with nets and lines or dive under the sea with them, they will lead you to the haunts of the specimen you desire, and you could not find yourself in safer or more enjoyable company.



▲ THESE FOUR CAVES contain the Gila Cliff Dwellings. The three on the right are connected internally

▲ ROAD DIFFICULTIES keep all but a few motorists away from the Gila ruins. The author (*at left*) has visited every National Park area in the West

The Gila
CLIFF DWELLINGS

By WILLIAM B. SANBORN

Supervisor, Dept. of Audio Visual Aids, San Francisco Public Schools

Deep in the wilds of New Mexico, the traveler who seeks rarely visited scenes can enjoy a vacation jaunt exploring the ruins of a vanished people

NORTH of Silver City, New Mexico, and situated deep in the Gila Wilderness Area, stands a group of picturesque and interesting prehistoric ruins. The Gila Cliff Dwellings National Monument is one of the most remote and seldom visited of all the areas administered by the National Park Service. In my visits to all the Parks and Monuments of the West, I have met only one other person who actually had visited these ruins. Of course, there have been others, but if you prefer a vacation trip to a spot where crowds are at a minimum, give this one a try some summer.

I had occasion to visit Gila Cliff Dwellings during the summer of 1951, and up until then it remained the only Park Service area in the West I'd not explored. The Monument is under the supervision of "Doc" Campbell, Acting Superintendent, who operates the Gila Hot Springs Ranch located near the ruins.

At present, travel to the Monument is limited by the road conditions between Silver City and the Hot Springs. The government information pamphlet on the area states: ". . . the last 16 miles of the road is passable and safe only to trucks with short wheelbase and four-speed transmission." And, as an old-timer in Silver City told me, "They aren't kidding either!"

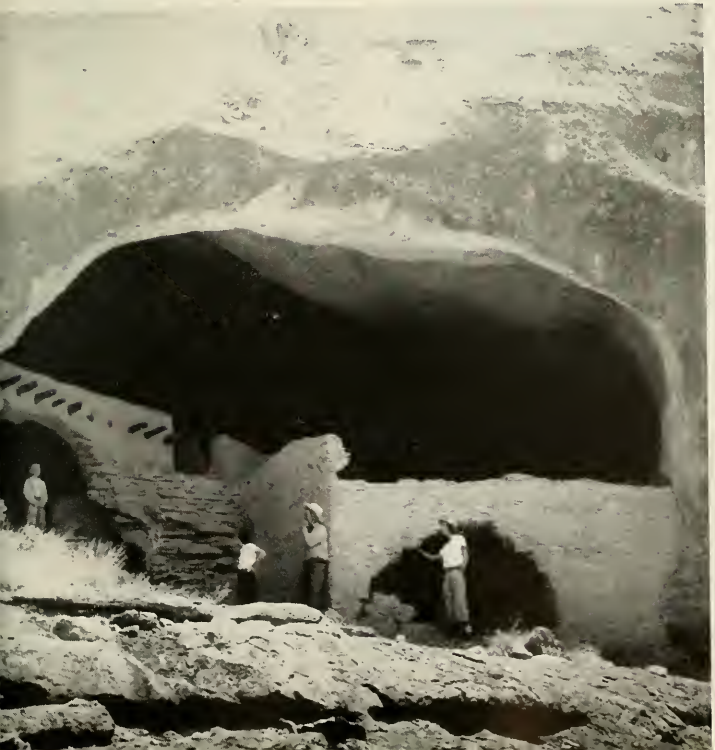
Even though the road may not be as bad as it sounds, you'll want a car that can straddle melon-sized pebbles in the road, negotiate barren rock surfaces, and ford the Gila River (which is no mere trickle). Otherwise, you'd better give "Doc" a ring on the Forest Service phone line from Silver City and have him pick you up at the entrance to Copperas Canyon. In case you're interested, "Doc" has cleared a landing strip behind the ranch. It will safely accommodate small planes with 100 h.p. or more.

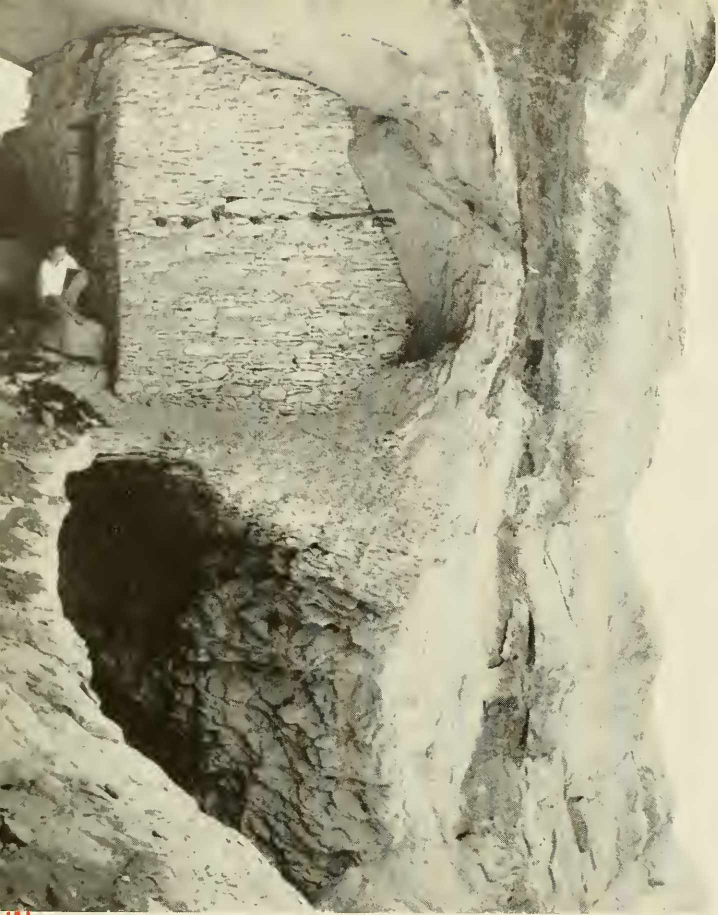
The Monument is only about 50 miles from Silver City, and actually all but the last 16 miles is easily driven in a passenger car in good weather. State Route No. 187 is the road out of Silver City; the pavement disappears at the quaint old mining town of Pinos Altos, and hard dirt surface carries you the remainder of the way, into the beautiful little ranching valley of Sapillo Creek. Copperas Canyon enters on the east side of this valley, and "Doc" had a jeep waiting for us at one of the ranches. Here we parked our car and switched our luggage and cameras to the jeep.

The trip up the canyon was all that could be expected—rough and beautiful. The top of the grade provides a magnificent view of the vast Gila Wilderness Area, over 567,000 acres in extent. Before us spread a superlative panorama of range upon range of forested mountains fading into blue haze, the forks of the Gila River, and canyons with their trout-filled streams, for which this area is famous. Here was one sanctuary of the Apache during their almost ceaseless resistance against the white man. Here also roamed the famous mountain-lion hunter of the West, Ben Lilly, whose exploits in this region are almost legends. The whites penetrated this wilderness during the late 70's with minerals and furs as their goal. By the 80's, settlement was under way, and mines, ranches, and hunting lodges had sprung up in the mountains and along the rivers. Despite these developments, the area was destined to remain very much a wilderness region owing to its inaccessibility; and as such, you'll find it today.

We took one last look toward the green patch in the distance that marked the Gila Hot Springs Ranch. The jeep had its nose pointed downward, and there it stayed until we reached the confluence of the north and south forks of the Gila River. As we hurtled and jarred down the crest of a steep ridge, I commented, "Pretty bad, isn't it!" The response from the driver's seat was, "Oh, I don't know, this is the new road—

THE AUTHOR'S WIFE, inspecting the ruins with Acting Superintendent "Doc" Campbell and two of his children. Note the original beams, hewn with stone axes





▲ THE AUTHOR beside a two-story building, which illustrates the problem the ancient people must have had in keeping their babies from wandering off the front terrace

you should have seen the old one!" My wife and I merely exchanged furtive glances, braced our feet, and clutched the dashboard for added support.

Five hours after leaving Silver City we rolled through the gates of Gila Hot Springs Ranch. The accommodations, food, and hospitality here were in keeping with the area—perfectly wonderful! The ranch, along with several summer homes in this lush valley, enjoys abundant hot water from the springs, king-sized vegetables from the gardens, heavily loaded apple trees, and magnificent scenery.

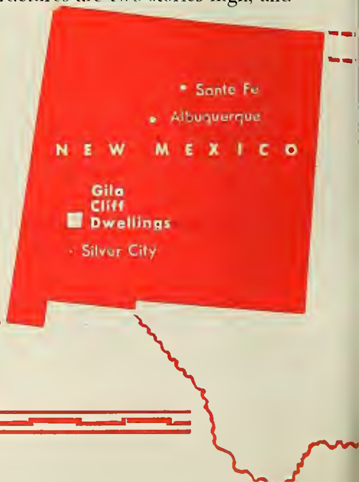
The ruins are six miles from the ranch and may be reached by hiking or horseback, or a truck can be driven to within a mile of them. I had heard many rumors about these ruins, most of them indicating that they were insignificant and uninteresting. I found none of these impressions to be true.

The Gila Cliff Dwellings are located in the sheer walls of a small side canyon that drains into the north fork of the Gila River. This canyon is beautifully wooded and supplied with an ice-cold stream that flows all summer long. These long-deserted dwellings peer out of four natural caves in the volcanic rock, about 150 feet up in the north wall of the canyon. When viewed from the opposite side, they are most impressive. These ancient houses are constructed of stone, mud, and timbers, probably cut from the canyon floor or atop the cliffs.

As we studied the view, we realized that we were looking at a prehistoric farming town. Living in their cliff dwellings, which were well designed to protect them from inclement weather and perhaps also against attack, these primitive farmers clambered down steep trails to till the rich bottom lands in the canyon. Every drop of water used for household purposes and for making the mud mortar for the buildings had to be carried up that same trail.

We spent several hours exploring the ruins and were surprised at the size of the caves. The most picturesque dwelling is located in the smallest cave and presents the visitor with a perfect T-shaped doorway. Although the dwelling looks small from the outside, there are at least eight rooms in it, with plenty of cave left for closet space.

The other three caves are quite large and are filled with ruins. They go back into the cliff some 50 feet; and, strangely enough, they are connected internally by natural arches between the caverns themselves. From the outside, one would suppose he was looking at three separate dwelling sites, but actually this is one large ruin, which at one time contained perhaps as many as 50 rooms. A few of the structures are two stories high, and



some of the rooms are of extraordinary size. One measures about fifteen feet by eight feet—a large room as cliff dwellings go.

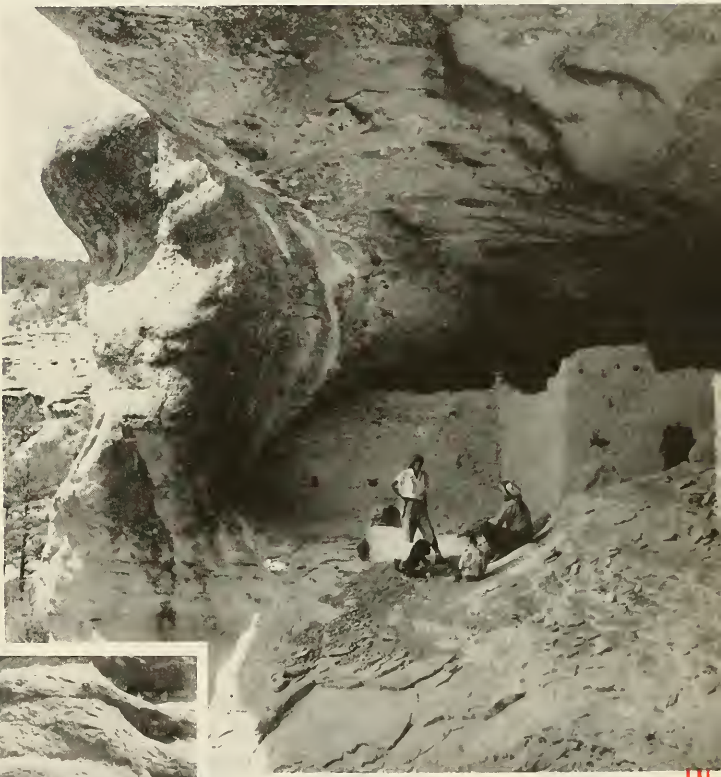
These dwellings were set aside by the Government in 1907. But until the time when they are carefully and scientifically excavated, we'll have to be satisfied with the meager amount of information at hand. The people lived here around 600 years ago. They made pottery, baskets, sandals, beads, and projectile points for tools and weapons, and they were skilled builders.

Although many of the walls and almost all of the roofs have fallen, the protection afforded by the caves has kept the dwellings in a remarkable state of preservation. Hand-hewn beams still protrude from many walls, and wooden lintels may be seen in their original places over doorways. The wood in these pieces will eventually be useful in dating the ruins by the tree-ring method. One loose piece of wood from the surface has been dated at about A.D. 1286. Hand and thumb prints are plentiful in the mud plaster; and corncobs, bits of woven yucca fiber, and beads frequently turn up in the dust at your feet. The heavily blackened ceilings of the caves indicate long-extinguished fires over which the food of the day was prepared.

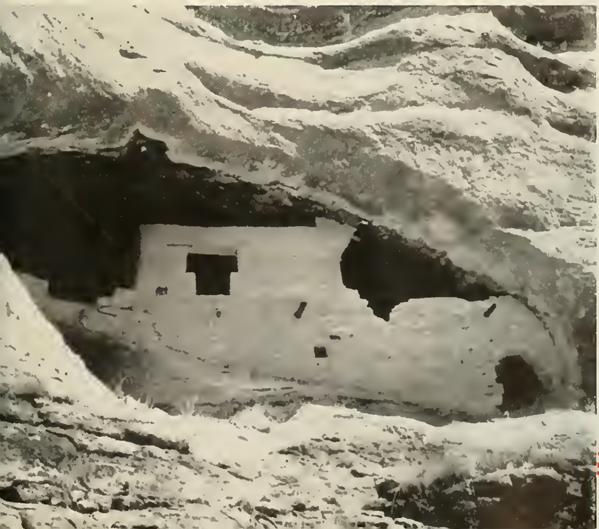
These ancient homes were real cliff dwellings. From their vantage point, one looks almost straight down into the canyon below. I presume that, whereas modern mothers scold with, "Don't go out in the street," the cliff-dweller mother said, "Now don't go over the edge!"

As we started the trek back to the ranch, we couldn't help wondering what caused these people to leave their homes. And where did they go? Did the Great Drought that began in 1276 force them out as it did some other Indian groups in the Southwest? Did warring tribes kill them, wreak havoc upon their cornfields, and steal their food supplies? Or did disease plague these ancient apartment house dwellers?

Perhaps when you visit the Gila Cliff Dwellings, you can arrive at some conclusion for yourself. As far as I am concerned, the secret rests with the winds that swirl the ghostly dust of centuries past, high in the four caves of the Gila Wilderness.



▲ THE SUPERINTENDENT'S CHILDREN in this view are examining beads and bits of turquoise that have lain where the cliff dwellers left them possibly six centuries ago



◀ THE MOST PICTURESQUE of the buildings contains a perfect T-shaped door

Fabre teaching the son who died in youth

The Screen

Authentic comments on films in the field of nature, geography, and exploration

Edited by Elizabeth Downes

THE producers of "The Amazing Monsieur Fabre" picked such a living likeness of Jean-Henri Fabre in the actor Pierre Fresnay that one of Fabre's close relatives is said to have fainted when she saw the actor rehearsing in a garden. Some of the insects, however, wouldn't recognize themselves from the descriptions on the sound track, to judge from the comments of one of the scientists I sat next to while viewing the film.

Mont A. Cazier, Chairman and Associate Curator of the American Museum's Department of Insects and Spiders, comments: "This new film, produced by Walter Futter, is the story of the trials and tribulations of one of the world's greatest students of animal behavior. Jean-Henri Fabre (1823-1915), as portrayed by the splendid acting of Pierre Fresnay, was a crotchety, opinionated recluse, possessed with a genius for observing small animals and recording his observations in fascinating language. During most of his 92 years, Fabre lived a life of poverty. He was subjected to considerable ridicule by his associates and other scientists, and his works were not called to public attention until 1910. Most of the film was photographed on location in France, and the scenes in his home at Avignon and in the court of Napoleon III are especially well done.

"One of the outstanding features of the picture, so far as the general public is concerned, are those portions showing the behavior of insects, spiders, and scorpions. Even though a few of the sequences are faked, they do not seriously affect the balance. A number of the sequences are of American insects, and we know that Fabre worked primarily on insects occurring in his immediate environment. However, these sequences serve admirably to illustrate the types of observations made by Fabre.

"The most serious defect in the picture is of a technical nature, and it is difficult to see why the producers failed to have the commentary checked by an entomologist. A front view of a beetle is referred to as a 'ferocious robber fly,' ant pupae are called eggs, the female of the trap door spider is shown leaving her burrow in the daytime, whereas these spiders are actually nocturnal creatures. The orb weaving spider was said to remove its wrapped prey to the nest, whereas they feed on the prey in the web and then drop the carcass to the ground. In one sequence the scorpion is said to be an insect rather than an arachnid, and it was stated that the male carried the female into a secluded spot for mating and that she ate the male after copulation. Both these actions would be very unusual and are of doubtful authenticity. The sexton beetle is referred to as being the only insect that takes care of its young, whereas there are actually a number of insects that do this.

"It is unfortunate that the film has a certain amount of nature faking and scientific inaccuracy, especially since it features the life of a world-famous biologist."

Before or after seeing this film, readers of Natural History might well enjoy reading *The Insect World of J. Henri Fabre,* edited with an introduction and notes by Edwin Way Teale.

FEW people could have missed hearing about 20th Century-Fox's widely advertised film "The Snows of Kilimanjaro," based on Ernest Hemingway's story by the same name and starring Gregory Peck, Susan Hayward, and Ava Gardner. Because several scenes from this film are set in Africa, readers of this column will not be surprised that we have asked the

Bonzo in "Bonzo Goes to College"

A hilarious and stirring film in which through deft photographic manipulations, a captivating chimpanzee is shown doing things a chimpanzee cannot learn to do. A Universal-International film production

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AFRICAN SCENES from "The Snows of Kilimanjaro"

African expert Dr. James P. Chapin, who reviewed "Latuko," "Ivory Hunter," and "Tembo," for his opinion of it.

"The white dome of Africa's highest mountain shows often in the background of this film," writes Dr. Chapin. "The picture deals not with mountaineering but rather with the personality of a writer and his difficulties with marriage. More of his adventures take place in Paris, on the Riviera, and in Spain than on the East African plains, where he goes first to shoot and later to photograph, perhaps also to solve the riddle propounded by his globe-trotting uncle: Why did that leopard climb to the snows of Kilimanjaro to die?

"Despite some splendid pictures of big game in Africa, this is no nature film. Vultures and hyenas are used to suggest the imminence of death, as Harry lies in camp with a badly infected leg. The significant events in his past unfold themselves as dreams while he tosses on his cot, and thus the audience learns how he came to find himself in this sad plight. Even so, one scarcely knows whether he deserves sympathy or not. Had he been clawed by a lion or gored by a buffalo, the end might well have been tragic. But the hyenas are cheated; the hum of an airplane announces its arrival, and we know Harry will recover in the hospital at Nairobi. Has he learned any lesson? Of that we still have doubts.

The story does not appeal to T. Donald Carter, who has just returned from Africa, where he camped and studied mammals for the American Museum. "The spectator does not feel that he is in a genuine camp in the heart of the game country," says Mr. Carter. "There are, however, two exceptional scenes, which are of interest. One is the herd of hippopotamuses being pursued in the small craft, during

▼ **HANS HASS** and his diving team

PREVIOUSLY REVIEW	WHAT THE EXPERTS SAID
The Big Sky White traders attempt to open Blackfoot Indian territory, 1832	Blackfoot Indians portrayed with disregard for fact
Ivory Hunter One man's struggle to build an African Wildlife Park	Authentic geographically. Marvelous shots of big game. Good conservation
Latuko Pattern of life of an African tribe	True picture of life in the southern Sudan. Excellent color photography
The Navajo Story of an Indian child facing today's problems	Superb documentary film. Photographed wholly in deserts and canyons of Navajo reservation in Arizona
Tembo African safari of Howard Hill with bow and arrow	Sheer bravado. Geography confused. Scarcely an instance where native or animal life is shown normally
Water Birds Disney vignettes from lives of water birds	Superb photography by experts in the nature field and entertaining synchronization of music and bird action

which several excellent shots were taken. The second was the visit of the marauding spotted hyena to the hero's camp. To me these two episodes were the outstanding parts of the picture."

"SOMETHING for the Birds," a new film released by 20th Century-Fox, is here reviewed by Dean Amadon of the American Museum's Bird Department.

"A beauteous damsel from the West arrives in the wilds of Washington, D. C., where she hopes to thwart the plans of a natural gas company that is trying to earn a couple of million bucks by drilling operations on a sanctuary that has been established for the protection of the rare California Condor. The Condors never appear on the scene, and their defenders though they eventually triumph gloriously, serve chiefly as material for assorted wisecracks. At most, one may hope that some of the spectators of this comedy will emerge with the knowledge that such creatures as rare birds and people interested in them do exist."

"UNDER the Red Sea," released by RKO, takes the viewer to Port Sudan, the base of operations for an expedition to photograph the depths of the Red Sea. The leader of the expedition, Dr. Hans Hass, is the Vienese Director of the Undersea Research Institute at Vaduz, Lichtenstein.

In reviewing the film, Dr. James W. Atz of the New York Aquarium says: "Hunting and photographing undersea life has replaced the African safari as the favorite pastime of adventurous persons. This motion picture is a result of such an aquatic expedition, where handsome men and a beautiful woman dive beneath the sea to observe its inhabitants and to hunt and photograph them. The photography is excellent, and its subjects are of compelling interest. The rich and varied marine life of the Red Sea and the clarity of its water are apparent. The underwater shots are clear and dramatic; in fact, the whole picture is put together with a sense of photographic artistry rare in this kind of film.

"The film's narration does not measure up to its photography, however. False claims are made that this is the first time the bottom of the sea has been explored by men carrying cameras and the first time the sounds of fishes have been recorded in nature. Too often the script strives for theatrical effect, while completely overlooking the really unusual aspects of a situation. For example, a large whale shark is called "the spotted tiger of the sea," when the remarkable thing is that this fish is absolutely harmless, and one of the divers practically rides upon the creature without its showing the slightest concern.

"One of the avowed purposes of Dr. Hans Hass' expedition was to study the response of fishes to underwater sounds and to the noises that they themselves produce. The demonstration that fishes responded to the strains of a Strauss waltz, gathering pair by pair to swim in stately circles about the submerged loudspeaker, seems incredible. We trust that Dr. Hass will soon give us the full details on this, and on his theory of the sonor sense of sharks, for these things are entirely new to science and need verification."

Dr. Hass, the Director of the Undersea Research Institute at Vaduz, Lichtenstein, is the producer of this commercial film. For readers who may not know the location, Lichtenstein is a mountainous, landlocked principality between Switzerland and Austria. It would seem a difficult place in which to study marine biology. But for a deep-sea diver it might have some of the carefree charm of a desert island, for its prince, Franz Joseph II, pays about $110,000 a year into the public treasury, and there are almost no taxes.

LETTERS *Continued from page 386*

the present century. While there were extensive orchards before that time, and before spraying came into being, much of the fruit crop was raised on land where mixed farming was practiced. Under such conditions, chickens, pigs, cattle, and horses had the run of the orchards, and the fallen fruit, which was practically all wormy, was eaten with relish by these animals. As a result, a goodly percentage of the insect larvae infesting the whole crop was destroyed. Birds also played a part in keeping down the pests, but it is very doubtful that they are less numerous in mixed farming areas today. Flycatchers, bluebirds, swallows, and other insectivorous birds can still be seen in orchards in about the same numbers as before, and the woodpeckers and nuthatches still make their rounds of the trees in search of hibernating codling moth larvae.

However, where orchards extend over large areas and where hedgerows, in which birds hide and breed, have been eliminated, the bird population has been very greatly reduced.

Spraying of orchards has undoubtedly had a good deal to do with the reduction of birds in orchard areas. This is particularly true since the advent of the newer insecticides, which are long lasting and not selective in their action. When the arsenates and lime sulphur were used, the majority of the harmless insects and the beneficial parasites of pests were not destroyed. Even so, there is a noticeable reduction in the general insect population, and the insect-eating birds are less attracted to the orchards where less food is available.

Another factor in increasing the amount of wormy fruit is the introduction of new pests, such as the Oriental Fruit Moth. Since this was introduced without natural enemies, spraying is essential to its control.

In the old days, fruit with a small amount of scab or with one or two punctures was accepted by the average buyer without question. Now the public has been educated to the point where only perfect fruits are considered edible. As a result, the grower carries on a rigorous spraying program. And failure

"And this one is a hunter."

Heiner photo

▲ A RED FOX caught fast asleep in the warm sunlight

to spray would result in practically no crop, because the parasites that did fairly well in keeping fruit pests under control before the days of spraying are no longer present in large numbers.

Beer Cans and Billboards

SIRS:

I was much impressed with your coverage of the Litterbug situation, as were many others in this recreation business who read my copy of NATURAL HISTORY Magazine. I only regret that more magazines don't present these facts to the American people.

As a matter of fact, your excellent magazine and fine co-operation have led me to place NATURAL HISTORY at the top of my magazine list for next year. Thank you very much.

JACK MIDDLETON
Gorham, N. H.

SIRS:

Upon reading the Letters in your September issue, I am aware that many persons have done what I have been meaning to do: congratulate you on the article, "The Great American Litterbug." The article about the Yellowstone Geysers horrified me even more, if possible. I sometimes wonder whether any educational method—outside of jail sentences or fines—is effective. I believe that that method is practiced in some of the cleanest European countries . . .

We have a similar problem . . . in Bucks County, Pa. . . . If you don't immediately pick up any paper or cans along your road, you will find you have a growing dump pile before you can turn around . . .

And while we are on the subject, it might be interesting to know how successful the western states have been in keeping advertising signs away from their beauty spots. I read a few years ago that some of the southwestern states were engaged in legal battles on the subject. The thought of that beautiful scenery being cluttered up with signs is really too appalling! We recently made a trip to the Delaware Water Gap, hoping to see some nice scenery—and found the place totally eclipsed by signs . . .

Another department of your magazine that I find very interesting is the Book Reviews. Everytime I read them, I find at least half a dozen books I would like to read . . .

MRS. ALICE L. HOPF
New York, N. Y.

SIRS:

I have noted with great interest in your Letters Section that NATURAL HISTORY Magazine is providing auto stickers urging people to Keep America Clean. Enclosed please find 25¢ in coin for one of these.

Since no charge was mentioned, I assume that none is necessary, but I hope this coin will enable you to print a few more and help cure the Litterbugs of their almost incurable habit.

ANTHONY THURSTON
Morningdale, Mass.

NOTES: NATURAL HISTORY Magazine gratefully acknowledges the contributions large and small that have come in from readers to help in the Clean-up Campaign. Stickers are still available. There is no regular charge. NATURAL HISTORY Magazine is anxious to send them to any persons who will use them.—ED.

SIRS:

We would be glad to receive some of the stickers to Keep America Beautiful. Our students have read the article on vandalism in your fine magazine.

We science teachers are especially glad to have the section on "The Screen." It is a good way for us to know and be able to counsel our students on the science movies.

Thank you for NATURAL HISTORY Magazine.

RUTH ARMSTRONG
Chairman, Science Department
Fort Smith Junior High, Ark.

SIRS:

We have recently subscribed to NATURAL HISTORY Magazine and have received the last two issues. Both are very pleasing, and we know that our readers will enjoy this addition to our list.

The year's subscription was purchased with money given as a memorial to a man who loved the out-of-doors.

MRS. RUTH S. WILCOX,
Librarian
Ida Public Library,
Belvidere, Ill.

SIRS:

Through some oversight we neglected to renew our subscription to NATURAL HISTORY Magazine, which we have taken for several years for our son. When he came home for the holidays from Stanford University, he was terribly disappointed to find that we did not have the late numbers. In his opinion this is the finest magazine on the market today. . .

MRS. ALEXANDER HAMILTON
St. Joseph, Mo.

"Why don't you talk to the people at Chase?"

"Chase's Commercial Banking Department handles thousands of problems *just like yours* each year."

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CHASE
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OF THE CITY OF NEW YORK
[MEMBER FEDERAL DEPOSIT INSURANCE CORP.]

Continued on page 391

son approaches her material with an insight based upon a wealth of personal experiences, and she writes with enthusiasm, candor, and an intimacy that cannot fail to hold the attention of the reader. Although her command of history and anthropology is better than adequate, she is most impressive when discussing contemporary New Mexico and the many socio-economic problems that face its colorful inhabitants. Her exposition, in fact, makes it abundantly clear why so many anthropologists and sociologists have selected New Mexico as a living laboratory for the study of human relations.

Although the illustrations are excellent and well chosen, the bibliography is a curiously random selection, omitting some important items and containing some inaccuracies.

HARRY TSCHOPIK, JR.

THE PLANETS: THEIR ORIGIN AND DEVELOPMENT

- - - - - - - - - by Harold C. Urey

Yale Univ. Press, $5.00
245 pp., 16 figs.

THIS is a research study on the origin of the earth and other planets and the formation of lunar topography, by a leader in physical chemistry. There is considerable discussion on the physics and chemistry of the terrestrial planets, their atmospheres, constitution, and evolutionary stages. Much attention is given to chemical processes acting on the giant planets. The author favors the Kuiper and von Weizsäcker idea for the origin of stars from dust clouds and of the planets similarly from a dust cloud surrounding the sun. Dr. Urey does not believe his conclusions offer the final story of the evolution of the solar system.

Urey holds that the earth's atmosphere was formerly quite different from its present state. It once contained much hydrogen, ammonia, methane, and other gases; and he explains the change that occurred. He believes the terrestrial planets were solid rather than molten during the formative eras. Since then, the temperature of Venus and the earth has been raised by radioactive minerals.

Urey says the surface features of the moon were evolved mostly during the end stages of the moon's formation by the fall of planetesimals, the largest being about 100 kilometers (62 miles) in radius, with iron in a silicate matrix. Thus the meteoritic hypothesis is upheld rather than the volcanic theory of lunar topography. Many astronomers may not agree with him, that the lunar mountain chains around Mare Imbrium are debris thrown up by the infall of the original meteorite that formed Imbrium.

The book is heavy reading and needs a background of astronomy, but it offers an immense amount of material for study. The text is loaded with astronomy, chemistry, physics, mathematics, geophysics, geology, and allied subjects. Many fine references occur in footnotes. The entire study is provocative and is a notable contribution to astronomy and cosmogony.

HUGH S. RICE

AMERICAN SOCIAL INSECTS

- - - - - - by Charles D. Michener and Mary H. Michener

D. Van Nostrand, $6.00, 267 pp., 109 pl.

NOT since the publication of Wheeler's *Social Insects* in 1928 has there been, so far as this reviewer is aware, any comprehensive discussion of the social insects as a group. For this reason alone, the present volume must be a most welcome one to all who are interested in these fascinating organisms. When to this is added the fact that the authors are themselves entomologists of distinction whose own researches have been very largely concerned with the orders of social insects and the further circumstance that this book is probably the first that has dealt with American social insects as a unit, its appearance becomes even more timely and welcome.

Essentially all the major groups of insects that are known to be subsocial or fully social in habit are treated, even including such inconspicuous and usually little-noticed forms as the Zoraptera. There are excellent discussions of such general matters as physiology, learning and behavior, caste determination, and possible courses in evolution for the development of the social habit. Last but not least, the volume, typical of its series, is superbly illustrated.

A few specific textual errors noted by this reviewer, though of little general import, should be recorded. In chapter 14, "The Primitive Ants," the statement is made that in the primitive Ponerine genus *Myrmecia*, the workers jump by means of the long mandibles. Actually this jumping is accomplished by means of the legs, particularly the third pair, in which the femur is thickened and muscular, the mandibles being used only for snapping and shearing. Again, there seems to be an error in the caption on Figure 74, which refers to a worker of the ant *Lasius*. This insect certainly does not belong to that genus but is more probably an American *Camponotus*. But these are mere details.

It is always a pity that works summarizing fields in which research is advancing rapidly must be "frozen" at a given stage, often just before some of the most interesting findings in the fields that they cover have become known. Such findings underline anew the need for such a work

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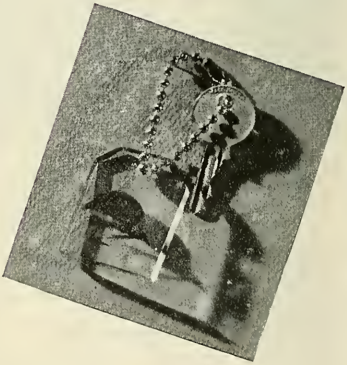

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77th STREET AND CENTRAL PARK WEST, NEW YORK 24, N. Y.

as this, and one hopes that the authors will periodically give us new editions, as the field of knowledge advances.

CARYL P. HASKINS

A FIELD GUIDE TO THE MAMMALS

- - - - by William Henry Burt and Richard Philip Grossenheider

Houghton Mifflin Co., $3.75
200 pp., 37 plates (24 in color), 40 maps

HERE is something new for the nature lover, a carefully planned pocket-sized field guide to the American mammals found north of the Rio Grande. It has been developed on the Peterson system of identification employed in so many famous field guides to the birds but never before for the mammals.

This field guide to the mammals is intended to aid the user in recognizing species found in any part of the region covered. Richard Grossenheider's superbly executed color drawings will in many instances serve to identify a species immediately.

Dr. Burt's brief, concise text emphasizes the special characters that are peculiar to the different mammals.

Of particular interest to the user of this guide are the distributional maps. With few exceptions, certain species of mammals are characteristic of a particular region, and the boundaries are more or less well defined. This simplifies identifications by cutting the possibilities to a minimum.

In using this simplified guide, the student should first consult the illustrations to determine to which group of mammals the specimen in question belongs. Arrows point to the characteristic marks mentioned on the opposite page. Then turn to the range map of the species in the group, and a quick glance at the clear-cut text should give the answer.

There are eight plates illustrating skulls, which will aid in identifying pickups or skulls found in owl pellets.

For obvious reasons, no attempt has been made to cover the numerous subspecies. It is assumed that the layman would scarcely be interested in trying to determine geographical variations of a particular species, and this field is covered in Harold Anthony's *Field Book of North American Mammals.*

In the text, 373 species are treated, which is about the minimum that can be used without losing what would be called a satisfactory representation. In addition to an index, the book contains a reference bibliography and a chart giving dental formulas.

This field guide to the mammals would be a useful and colorful addition to the library of everyone interested in American wildlife.

GEORGE G. GOODWIN

THE TUNDRA WORLD

by Theodora C. Stanwell-Fletcher

Atlantic-Little, Brown, $3.50, 266 pp.

THE author, who has previously written *Driftwood Valley,* says in her opening sentence, "The figures in this book are all imaginary and are not intended to represent any actual persons." This story of a summer spent at Churchill on the west coast of Hudson Bay is not quite a novel, however. The real protagonists are stated in the second sentence: The people's "behavior and philosophies, the situations and natural environment, I have tried to make as accurate as possible." Thus we have, surprisingly, a book with an undeceptive title.

It describes the flora and fauna—especially the birds—the weather, the types of people of the tundra at its southern edge, a package containing some solid items even though not a scientific monograph. It is wrapped up in shiny colored writing and presented with the triumphant pleasure of a person who has discovered just the right gift. The book is written from the viewpoint of a woman naturalist and photographer, a young graduate student escaped from a regulated New England life to the unconventional realistic frontier, who finds it satisfying. In fact at times she gets ecstatic about it. But past the middle of the book, the "sensitive" pastel passages grow shorter, and it gains force and speed steadily.

Tundra World should be interesting to at least four groups: botanists and ornithologists who have had field experience in some other northern area and who would like to compare this biologist's experiences and observations with their own; young people who are acquiring a good knowledge of natural history and enjoy a pleasant quiet romance running through the account between collecting trips; people who by necessity must be armchair travelers and who would like to visit in imagination the west coast of Hudson Bay; and the military men who were stationed there during or after World War II and would enjoy knowing what it was like before the war.

The author is not solely an apologist or a press agent for the Arctic. She tells the unpleasant along with the pleasant, but definitely comes through with an affirmative response to the questions of the isolated strong self-reliant life of the North.

MARGARET LANTIS

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AFRICAN WATER BABIES

Continued from page 413

a matted growth of head-high cane. Although we could not see the river, we could hear it gurgling peacefully just a few feet away through the wall of vegetation.

Suddenly the guide stopped in the trail and put a finger to his lips; then he began to move again, this time a little more cautiously. After another hundred yards or so, the path took a sharp turn to the left, and at this point the guide stepped to one side to let us by. Ahead, we could see the river through a break in the cane. We passed through the opening, and the sight that met our eyes was in itself worth the trip to Africa.

There, not 30 feet from where we stood, was a herd of 20 hippos. Their bodies were almost entirely exposed, not through choice but because the dry season had reduced the level of the Sabi River to an all-time low. The water barely reached the bellies of the standing animals, and only those that were lying down could hope to moisten their bodies. Great beads of red perspiration glistened on their necks and about their ears. It is during such dry periods that this oily lubricant provides one of its two vital services, for it prevents the drying out and subsequent cracking of the skin when the animal is exposed to the heat of the sun. The other, of course, is the water-resistant property with which it imbues the skin tissue.

As we stood there on the bank, the hippos eyed us suspiciously, and the nearest bull swung around so that he could observe our movements more easily. I was certain I could detect an element of antagonism in his glance.

Customarily, hippos are inoffensive where man is concerned, or so I had been told. Yet I remembered stories describing the fury with which cows charged when they believed their young to be in danger. And there was the tale about a bull that, after demolishing a canoe, had bitten the occupant almost in half. There were other discomforting anecdotes—accounts of hippos assailing swimmers or trampling natives to bits at night on land, and even a few incidents involving hapless souls who had wandered too close as hippos siesta-ed near the shore. In each instance the attacking hippo had been given some cause to feel its security endangered, but that fact was of little comfort to the victims in question. They probably did not feel much like being objective—nor at the moment, did I. These recollections had a disturbing effect, and that Sabi bull, so near and so fully aware of our presence, looked awfully big.

Hastily I snapped picture after picture, first of the group as a whole, and then of individuals—the bulls, the cows, and the young. Then, with a feeling of relief, I edged away, moving along the bank to a position from which I might watch the hippos with a little more peace of mind. It was then that I noticed a pair of hippos quietly nuzzling each other, well away from the rest of the herd. I shifted closer along the bank for a better picture, and as I drew nearer, the larger of the two ceased its nuzzling and glared at me in unmistakable annoyance. Suddenly the truth of the situation struck me: this was romance, hippo style. It seemed like an appropriate time to leave.

I have always found these creatures interesting, and I guess most people feel the same way, to judge from the popularity of the hippo pool in any zoo.

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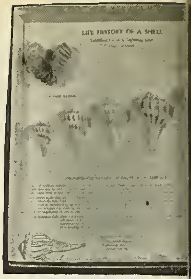

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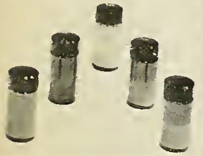

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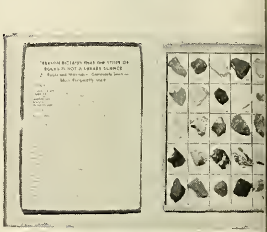

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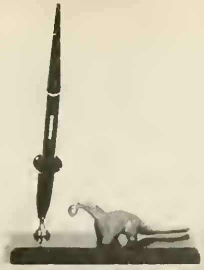

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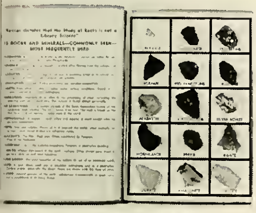

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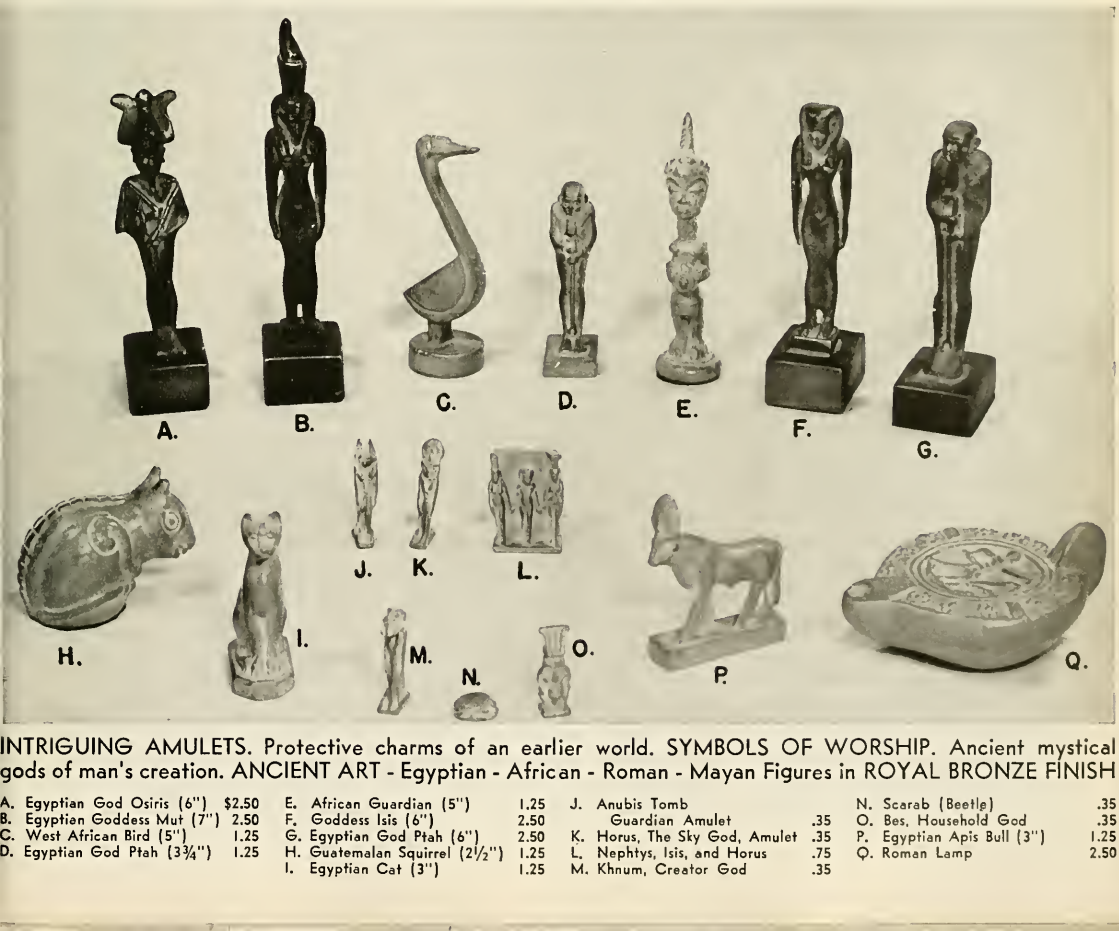

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LETTERS

Luminous Wood

SIRS:

A few years ago we cut down a hickory tree, and from time to time we have cut away at the stump. Recently we noticed that part of the stump and the chips seemed to give off a light and actually shine in the dark.

We are puzzled by this and would appreciate any explanation you can give.

CHRISTINE SERAYDARIAN
Greenwich, Conn.

The following comments are offered by Dr. Henry K. Svenson, of the American Museum's Department of Forestry and General Botany:

This phenomenon is well known. Camp boys and country people generally call it "phosphorus" or "punkwood." It is caused in a case like this by the slow oxidation accompanying the rotting of wood under the action of various species of fungi. Chief among these are the rootlike structures of the bracket fungi (Basidiomycetes). Personally, I have seen this only rarely, but some people have seen it quite frequently. I suspect moisture conditions may have a good bit to do with its appearance.

A great deal of research has been carried on in recent years on the luminescent bacteria in the ocean, and a somewhat similar condition is present in many deep-sea fishes.

Bully Butterfly

SIRS:

Two years ago, my wife and I saw something at our home in Darlington, Indiana, that might interest those with a taste for the curious.

For at least fifteen years, a pair of barn swallows have nested just inside the barn door. We also keep a cat, and the birds are apt to "dive bomb" her whenever she ventures into the back yard.

On an afternoon in August, we sat on the back steps; and the cat, which lay on the grass, only received an occasional attack from the birds as they came and went. But as one of the swallows rose from a dive, I said, "Now it's after a butterfly." My wife jumped up and cried, "No, the butterfly is after the swallow!"

Sure enough. Back and forth over the lawn and garden and chicken yard, the butterfly stayed a foot or two behind as the bird twisted and turned in definitely evasive tactics. In all, the chase lasted almost a half minute, and we estimated that it covered a total distance of 200 or 300 yards. It struck us as so ridiculous that we both burst out laughing. I got a good look and feel sure it was the common Black Swallowtail. The surprising part to me was that the butterfly could keep up with the bird. However, the *Papilio* may have been putting on an exhibition of speed, and the swallow may have been slowed by its maneuvers.

What could have been back of all this?

DAVID H. THOMPSON
Senior Naturalist

Forest Preserve District,
Cook County, Ill.

The following comments are offered by Dr. Frederick H. Rindge of the American Museum's Department of Insects and Spiders:

A number of our North American butterflies are noted for their pugnacious habits. They will take out after birds, dogs, humans, etc. The swallowtails are not usually recognized as being among the more pugnacious, but it is quite possible that the event described by Mr. Thompson represents less of a departure from their usual habits than many people would suppose. Dr. Alexander B. Klots gives some information on this subject in his *A Field Guide to the Butterflies.* Pugnacity among butterflies is therefore far from unknown, but it is of interest and much more needs to be known about it.

From a Four-Subscription Reader:

"Your Magazine is superb, and I am hoping to engage the interest of young people as well as adults for whom I am taking out subscriptions."

Expedition to South Sea Island

Dr. Norman D. Newell of the American Museum's Department of Geology and Paleontology returned in October as leader of a seven-man expedition to the island on which the voyage of the raft Kon Tiki ended. Raroia atoll, as it is called, is also familiar as one of the islands in the novels of Nordhoff and Hall. More pertinent to their study, however, is the fact that this island and its neighbors are among the finest coral atolls in the world. Dr. Newell's researches strengthen his adherence to the classic theory of Charles Darwin and James Dwight Dana on the origin of coral islands, in contradistinction to a more recent theory proposed by Dr. Reginald A. Daly.

Dr. Newell reports that the native inhabitants of Raroia work for wages about the same number of days each year that the average American takes as vacation. However, with the money thus earned, they are purchasing canned goods, civilized clothing for the men and cloth for the women, and even radios. Although this is one of the farthest islands from any continent in the world, the native myths and music are being forgotten, because the people are tuning in to hillbilly music from Dallas, Texas.

Other members of the seven-man team studied the native population, the plants of land and water, the shells, and the fishes of the atoll. The scientists lived in thatched huts built by the natives, but all the food for their 630-man-days on the atoll had to be brought in from the outside, except for fish, breadfruit, and papayas.

The expedition was the third in a series of five planned to study different areas of the Pacific. It was sponsored by the Pacific Science Board of the National Research Council and received the co-operation of the United States Navy and the French Government, which owns Raroia. Financial assistance was provided by George S. Vanderbilt and by grants to the American Museum from the U. S. Office of Naval Research and the Humble Oil and Refining Company of Houston, Texas.

The party included Bengt Danielsson (Swedish anthropologist), Dr. Maxwell Doty and his assistant Jan Newhouse (plant specialists of the University of Hawaii), Dr. Joseph Morrison (zoologist of the U. S. National Museum), Dr. Robert Harry (fish scientist from the Philadelphia Academy of Science), and Dr. Newell's assistant, John Byrne, of Columbia University. Valerie Newell, the leader's wife, was in charge of procurement and also active as secretary to the expedition during its preliminary stages.

Insects of Yucatan

Collectors of stamps, coins, match covers, and the like may be interested to know how many specimens a good collector of insects can gather in two or three months.

Mr. John C. Pallister, whose expedition to Yucatán was announced in our September issue, returned to the American Museum of Natural History recently. He brought with him about 14,850 insects and spiders collected from parts of Yucatán not previously represented in the collections of the American Museum of Natural History. Some of these are new species. Many are new records for Yucatán.

His expedition was sponsored by the American Museum and the C. R. Vose Exploration Fund of the Explorers Club.

Cutting in National Forest Hits New High

The volume and value of timber cut on National Forests for the three months ending September 30 exceeded that for any other single quarter on record, the U. S. Forest Service has announced. Approximately 1,627,800,000 board feet were cut during the three-month period, an increase of 10 per cent over the cut for the same period a year ago.

NATURAL HISTORY

The Magazine of the American Museum of Natural History

Alexander M. White, President — Wayne M. Faunce, Assistant Director In charge of Publications — Albert E. Parr, Director

VOLUME LXI—No. 10 **DECEMBER, 1952**

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From a color photograph by Helen Cruickshank

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You will find Natural History Magazine *indexed in* Readers' Guide to Periodical Literature *in your library*

THE COVER THIS MONTH

The male Scarlet Tanager is one of the handsomest birds to visit the eastern United States in summer. It is a member of a strictly American family, largely confined to the tropics, to which this species also retires in winter, going as far south as northern Bolivia.

In spring, when the leaves are not fully grown, the scarlet tanager may be as conspicuous as a flash of flame, but amongst the heavy foliage of summer, it is surprising how easily he may be overlooked. The call-note is distinctive—an unhurried *chip-chirr*—, and the warbling song is quite recognizable although faintly suggestive of that of a robin.

The nest is a weak structure, built by the female alone, sometimes in a single day, and is placed in a tree at low to moderate elevations. The four to five eggs are greenish blue with specklings of brown.

In autumn the male changes his brilliant dress to one of duller olive, much like the female except for his darker wings and tail. During the period of change he has a curious appearance, in his mottled livery. John T. Zimmer

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JOURNAL OF RESEARCHES

. . . H.M.S. "Beagle" (A Facsimile reprint of the first edition, 1839)

- - - - - - - - - by Charles Darwin

Hafner Pub. Co., $7.50
615 pp., 16 illusts.

CHARLES DARWIN's *Journal of Researches* is the outstanding best seller in the history of exploration. The book is the subsequently edited text of notes written nearly every day during the epoch-making cruise of the "Beagle," between January 1832 and October 1836. It was first published in 1839. How closely it follows the original manuscript was not revealed for nearly a century when, in 1933, Darwin's niece, Nora Barlow, brought out in book form the diary itself.

The "official" narrative of the circumnavigation of His Majesty's ships, "Adventure" and "Beagle," was published in two volumes by Captains Fitzroy and King in June, 1839, and shortly thereafter the youthful scientist's *Journal* was issued as a third volume. About the same time it was independently published as a trade book by the Messrs. Colburn of London. Copies of the latter edition are now very rare. In bringing out the present facsimile reprint in 1952, the Hafner Publishing Company has rendered an important service. The value of the text is enhanced by the addition of reproductions of 16 of the engraved plates from Fitzroy's report.

Darwin's *Journal* is so well known that it would be supererogation to point out its importance and charm. Not only is it a record of the daily observations of a keen-witted recent graduate of Cambridge with a thirst for the underlying meaning of things, but, more than that, it is a living image of vast expanses of our earth when they were still young with reference to the experience of civilized European man. Most important of all is the fact that it contains the germ and discloses the early development of ideas that have had an unequalled influence upon the whole field of human thought, namely Darwin's later crystallized explanation of how the evolution of life may have come about.

Somewhat to the chagrin of the redoubtable Captain Robert Fitzroy, the *Journal* of his young naturalist nearly eclipsed the other "Beagle" narrative in the world of intellectual interest. The work has reappeared in innumerable editions and, as much as any secular book, it has become part of the general consciousness of mankind. Darwin himself, who published many more painstaking studies, into ripe old age, always held his first literary child in particular pride and affection. An advantage of this latest edition that seems to the reviewer to be more than sentimental is the fact that we can now see the text, line by line and page by page, just as it was first delivered to its author at age 30.

R. C. MURPHY

JOURNEY INTO WONDER

- - - - - - - - - - - - by N. J. Berrill

Dodd, Mead and Co., $4.00
338 pp., 28 illusts.

THIS is an interesting and entertaining account of early discoveries both in a geographical sense and in ideologies. The author draws heavily upon the recorded writings of the explorers themselves, or of persons who were in the party, and thus lays a basis of firsthand observation. He frequently quotes directly. With the basic pattern of the operation outlined, he often speculates as to the rationalization of the explorer, the ideas that drove him to a goal in spite of hardship and obstacles, and finally he discusses some of the "wonders" connected with a given journey and gives his own explanations and conclusions.

The greater part of the book is devoted to pioneer exploration—Columbus discovers a new world; Hawkins, Drake,

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and Dampier widen exploration in the Western Hemisphere; the South Pole draws men like Cook; and then, with the trails blazed, pioneers such as Darwin and Humboldt explore the natural resources of the new lands and journey into intellectual wonder.

The selections from recorded human history range from the time of Columbus up to the present; but in delving for incidents in geological history, the author gives opinions on happenings that may have taken place many millions of years ago. The reader is given a pretty fair insight into what the "new world" has meant to men of an exploratory mind and how it acquired its resident animal life and sent emigrants to the "Old World."

The author is intrigued by the various puzzles and tries his hand at offering explanations. In the main, these seem plausible and often have the sponsorship of acknowledged authority.

There are occasions, however, when he has been careless in checking available data and his statements are open to challenge. For example, on page 27, Columbus (along the eastern shore of Cuba) "came across the scent of a skunk," an animal unknown to Cuba.

Harold E. Anthony

EARTH SONG

A PROLOGUE TO HISTORY

- - - - - - - - by Charles L. Camp

University of California Press, $5.00
127 pp., illusts.

IN this handsome and beautifully illustrated book, Charles L. Camp tells the story of California from the early days of earth history to present times. It is a fascinating story, ably presented by a man who, as Professor of Paleontology at the University of California, is thoroughly acquainted with the geologic history and the extinct animals of that state, and who, as a keen student of the early settlers on the West Coast, speaks with authority about the course of human history in this region. There is no doubt as to the authenticity of the book throughout; the reader can accept it with complete confidence.

Fortunately this book is also very well written. Each subdivision (there are no formal chapters) is introduced by an almost poetic preface, and these several introductions serve to put the reader in a receptive mind for the text that follows. The bulk of the writing is, however, down to earth, and presents the subject in very clear terms. There is much solid information in the form of discussions, diagrams, and figures. Indeed, the scientist will find this book as useful as will the general reader, although the work is obviously intended for the latter.

The book opens with a discussion of how California has been affected by earth processes such as mountain uplifts and earthquakes, invasions of the land by the sea, erosion, and sedimentation. It then goes on to trace the history of life from the periods when early invertebrates and primitive fishes inhabited the seas, through the rise of land animals and the ages when dinosaurs and other great reptiles led to the time of mammalian evolution and finally the great Pleistocene ice age. The latter portion of the book is concerned with Man. An account is given of the appearance of the first men on the earth, and from this the story proceeds to the prehistoric inhabitants of California. Brief accounts of the early Indians and of discoveries and settlements by Europeans follow in order. The book ends with a consideration of present-day California and of what the future may hold for the state.

The book is beautifully illustrated by end papers and many full-page plates, in which restorations of the ancient animals and the early human inhabitants of California are delineated by William Gordon Huff. The quality of these illustrations is high and adds greatly to the esthetic and scientific value of the book. In addition, there are maps and line drawings, many of them by Owen J. Poe. At the back of the book are tables and a useful glossary.

Although the geographical boundaries of this book are in a way limited, it treats a subject with wide implications and should appeal to many people beyond the confines of that state. It is one of a series designated as "The Chronicles of California."

Edwin H. Colbert

ANGKOR AND THE MANDARIN ROAD

- - - - - - - - by Martin Birnbaum

Vantage Press, $6.00
167 pp., 72 illusts.

TWO essays comprise this work of evocation. The first deals with one of the great architectural treasures of mankind—the ruins of Angkor in Cambodia, between Thailand and the Indo-China coast. Here, when the Gothic cathedrals of Europe were being built, the Khmers had already firmly established their empire and had developed the art and architecture whose traces and ruins may now be seen only by cutting away the growth of the jungle. Although it must be admitted that the recovery of a "lost" civilization and the melancholy aura that surrounds ruins contribute in some degree to our interest in Angkor, the sheer beauty and perfection of its structures constitute its major claim to its enduring fascination for those who care about such monuments of the human spirit and imagination. Mr. Birnbaum clearly has felt this strongly and writes with much feeling of his impressions in

Continued on page 476

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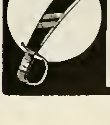

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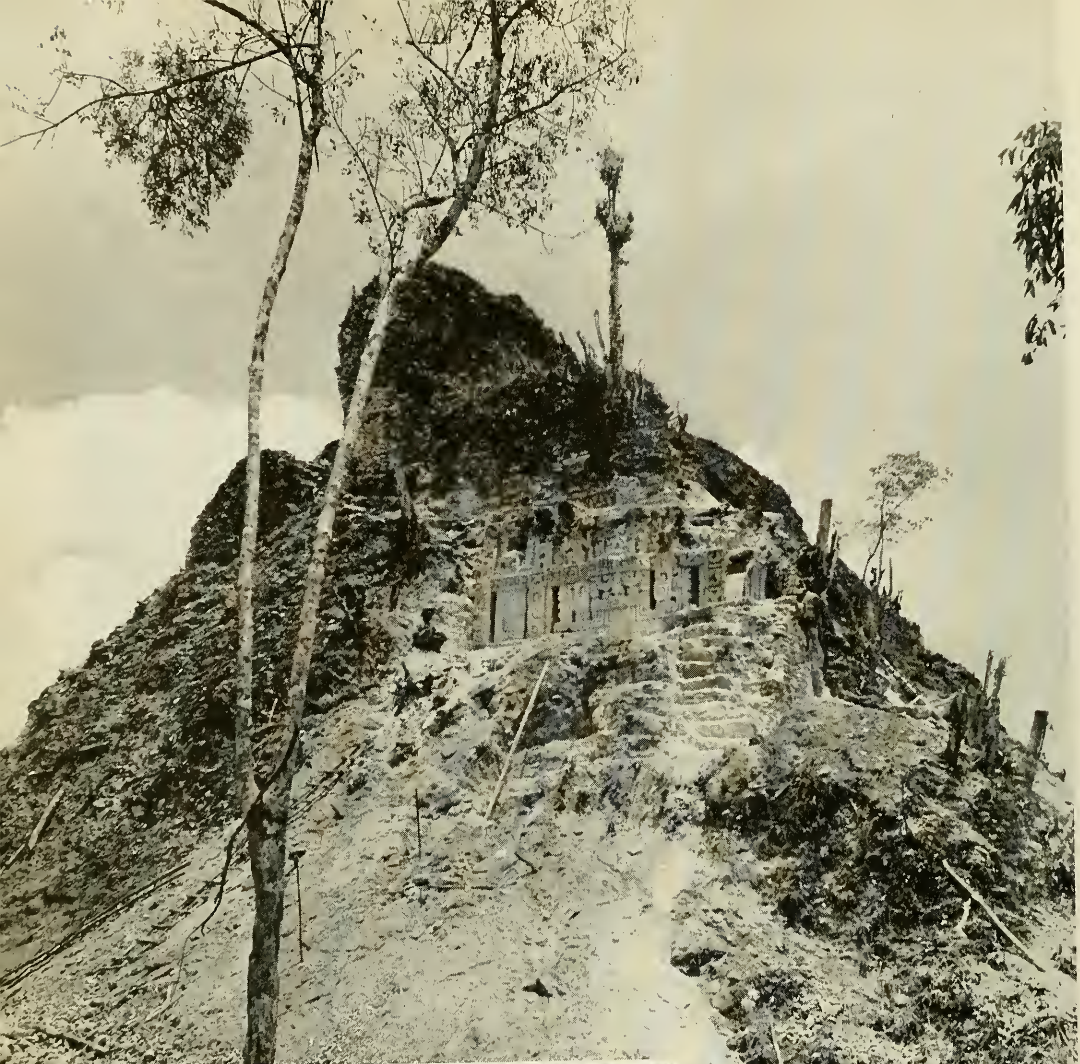


University of Pennsylvania Museum photo

▲ THE PALACE called Xunan Tunish, or "The Virgin of the Rock," commanded a breath-taking view for miles in every direction

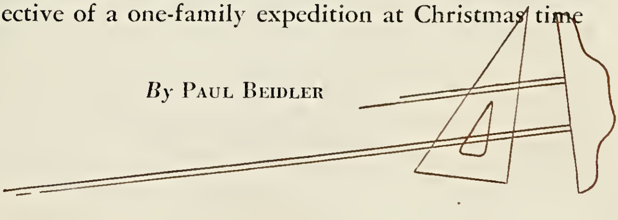
Paul Beidler photo

◄ THE AUTHOR crossing the Mopan River on the ferry specially built to carry the expedition jeep. Peter is in the back

An architect in MAYALAND

An ancient Maya palace deep in the jungle of Honduras was the objective of a one-family expedition at Christmas time

By Paul Beidler



MY assignment in British Honduras was necessarily a brief one, for I could spare only a few weeks in the heart of winter from a busy architectural practice to undertake an archaeological commission for the University of Pennsylvania Museum.

In the late 1920's and early 30's I had been connected with several Museum expeditions to Egypt, Italy, and the Near East. Through the intervening years, engrossed in the practice of contemporary architecture, I had found my earlier interest in archaeology not fading but deepening and broadening as I attempted to give architectural expression to my own age.

So, when the opportunity presented itself to undertake a study of an ancient Mayan palace near the western edge of British Honduras, it seemed an appropriate thing to go and have a look at what my fellow American architects were doing back in the ninth century, long before the Spanish invasion.

I found singularly little information available on present-day British Honduras. Much travel literature has been written on neighboring Guatemala and the other colorful republics of Central America, but little was known about the British Colony. By far the best source was a pamphlet prepared by A. H. Anderson, District Commissioner of the western district of Cayo, whom I later came to know and admire.

From other less authentic sources I was supplied with dire tales of the dangers that lurk in the tropics —deadly snakes that lie in wait for the foot of the unwary, ticks that bury their heads deep in the flesh to produce festering sores, chiggers and insects to plague one night and day, and malaria-bearing mosquitoes. I heard also of polluted water threatening typhoid, and of the amoebic dysentery lurking in fresh vegetables and fruit. Added to these were a few special horrors such as a fungus growth in the ear, and jungle rot. Although my past archaeological experience led me to discount these tales, I was forced to give them some consideration since I was planning to take along my wife and four children ranging in age from seven to thirteen.

Despite some uneasiness, I proceeded to get everyone stabbed with the necessary vaccinations and inoculations and to assemble scattered birth certificates for passports. I was sure most medicines would be available in Belize, but since most of our time would be spent in the jungle about a hundred miles away, I gathered together a formidable looking satchel of medicines, including several snake bite kits, plenty of sulfadiazine, insect repellents and insecticides, water purifying tablets, powerful germicides, first-aid equipment, paludrine for malaria, and a doctor's manual describing in gruesome detail every known disease. It was quite a relief to find upon arrival that we could, if necessary, secure the services of Dr. Hulse, the District Medical Officer, an attractive and competent young woman physician. She was at a small infirmary some nine miles by hike, canoe, and jeep from the jungle site where we were to do our work.

The children, gleeful over the prospect of entering into an exciting adventure, submitted gamely to the series of shots and had a hilarious time on the journey to New Orleans, untroubled by anxieties about tropic hazards.

Our plane left New Orleans in a typical wintry drizzle, but within a few minutes we could see the white caps dancing on the Gulf and were soon riding up in the sunshine above banks of cloud. Before long, the shores of Yucatán came in sight and we were flying over checkerboard villages and vast areas of empty jungle and swamp. Veils of cloud kept intercepting the view, but it seemed one continuous marshy wilderness.

Suddenly the plane was veering low, and we were gliding onto a hot and pebbly airfield outside of Belize, the capital of British Honduras. The nine-mile ride into Belize careened us through an

▲ **Margaret Beidler** with daughters Jo and Sue, crossing the river in a primitive dugout

Paul Beidler photo

endless mangrove swamp on which a narrow sandy road had been fastened.

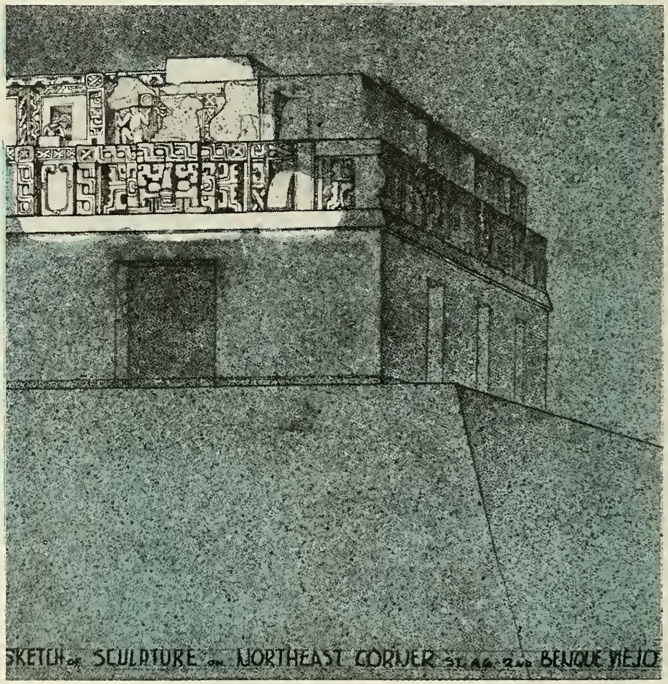
The Palace Hotel, to which I had cabled ahead for reservations, turned out to be an ancient, almost deserted three-story frame building set in an attractive garden tangle of flowers and foliage. Verandas and halls were open, and rooms were shuttered on both sides to permit maximum ventilation and minimum privacy. Ragged mosquito nettings hung above narrow cots, but we were assured that no nettings were necessary in December. Any limitation in accommodations was more than compensated for by the cordial welcome of the proprietress and the smiling, willing service of the small part-Chinese boy who quietly and skillfully served us appetizing meals.

The Belize telephone operator turned out to be a fountain of information. She could tell me where each person I was seeking might be found, and she followed my own progress about the town, reporting to various people where I was or had just left. Long distance calls, I discovered, were considerably more expensive after four o'clock, since the regular phone operators kept business hours, and it behooved other people to transact their business during those hours.

The following day was spent arranging to release the jeep from customs. It had been sent down by the Museum, but all shipping documents for it were mysteriously lacking. I also established a bank account, paid a visit to the British Colonial Secretary to obtain the permit to engage in archaeological work, and commenced making arrangements for housing accommodations for the family in the village of El Cayo, nine miles from the jungle site of Xunan Tunich. Thanks to the efforts of the District Commissioner, a Government house owned by the Forestry Department was placed at our disposal.

After five in the afternoon, we set out on the 85-mile jeep trip from Belize to Cayo, our luggage and bedding following on the truck of an obliging American settler. As dusk fell, we crawled gratefully into the winter coats that had seemed so burdensome in Belize. A full moon bathed the narrow white road and the jungle growth through which it ran. Remembering tales of the tropics, we

Delineated by Clark Bachman, Paul Beidler photo


SKETCH OF SCULPTURE ON NORTHEAST CORNER ST. A6 2ND BENQUE VIEJO

➤ Sketch of stucco frieze on the northeast corner of the palace, showing the probable form of the edifice, now largely hidden beneath tons of earth and vegetation looked for pumas and jaguars, tapirs and ocelots, lurking within the dense foliage. But we saw nothing except some lovely white herons, some grazing cattle wandering across the road and moving sluggishly away as we passed, and the large red-eyed birds, which squatted on the road until we were almost upon them and then flew off with a great rush of wings. There were dozens of these birds, their eyes gleaming blood red in the distance as our headlights reached them.

We were delighted whenever we came upon a little settlement of thatch-roofed houses clustered along the edge of the road. Each hut had its soft glow of kerosene lantern and fragrant smoke from the open fire. Outside, the walls were made of slender poles lashed together with vines. Inside, many were papered with old newspapers. The dark faces of the inhabitants peered at us, alert, friendly, and self-contained.

We passed no cars on the way, and in the eerie moonlight it sometimes seemed that we were driving west into nowhere. But at last we saw more clusters of houses and realized that we must be approaching El Cayo. In front of the clock tower of the Government Building we found Mr. Hopun, the Museum's agent, waiting for us, the telephone operators having obligingly kept him informed of our progress as the jeep passed various points along the way.

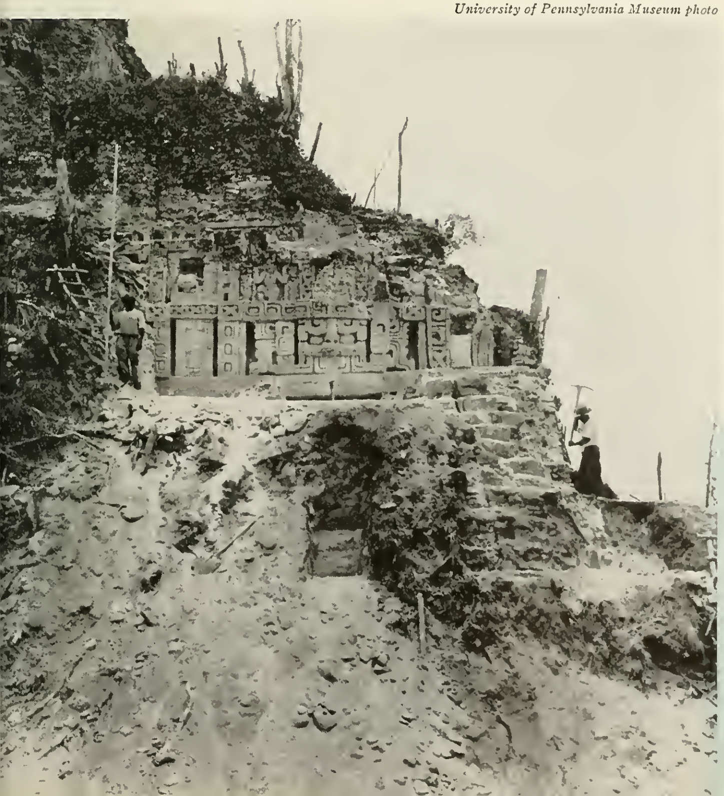
Mr. Hopun greeted us warmly and conducted us to the house that he had had put in readiness for us. This was but the first instance of Leocadio Hopun's kindness and concern for our welfare. A highly intelligent man of proud Chinese and Mayan heritage, he and his attractive mestizo wife and their two beautiful young daughters, Oly and Eri, became warm friends of our entire family. Through them we experienced all the delights that El Cayo had to offer. He took us to the holiday dances, and his wife introduced us to the choicest cooking of the region. His daughters took our youngsters swimming and boating on the river.

The first morning we woke to find ourselves looking out on a neat little village nestled in the curve of the beautiful green Macal River and surrounded by vast hills. In the early morning mists, these hills resembled the misted mountains of the Chinese landscape painters. In broad daylight, many houses turned out to be hand-hewn frame dwellings with the corrugated roofs that are needed for collecting water for the dry season. Outlines were softened by flaming bougainvillea, poinsettia trees, and sour orange trees. On the outskirts of town were the more attractive thatched houses, known locally as "trash" houses.

Paul Beidler Photo

▲ PETER BEIDLER helped with the measuring and mapping and could get where others found it difficult

University of Pennsylvania Museum photo



◄ TRACES OF A LATER STAIRWAY leading to the exposed portion of the palace can be seen. Centuries have passed since regal functionaries climbed its steps to perform the ceremonies of state or shrine, but the intricate designs still bespeak a rich and cultured age

Paul Beidler photo

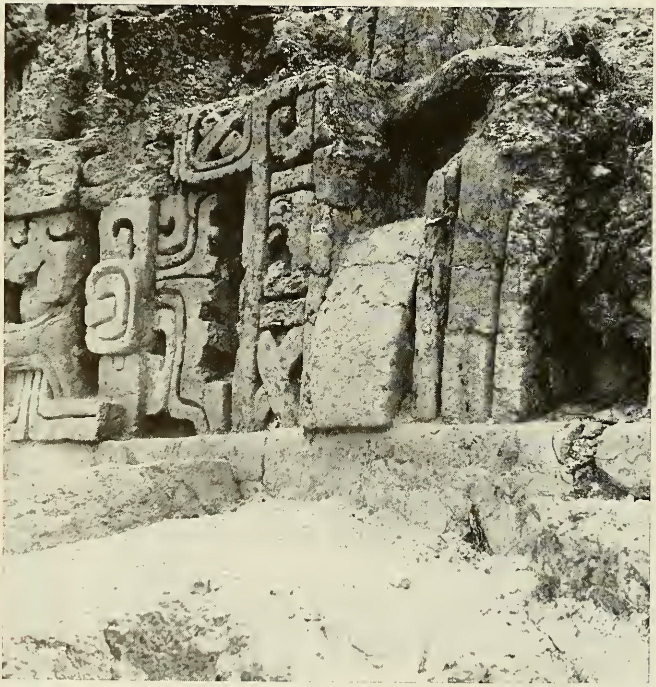
▲ The author's daughter Jo, in company with his chief assistant Jacinto and other friends from the Indian village

Paul Beidler pho

▲ An energetic midwinter "holiday." Surveying the site required some of th footwork of a mountain goat, and th tropical lowlands can be hot even a Christmas time

▼ A detail of the frieze, recently excavated under the direction of Dr. Linton Satterthwaite. Accurate measuring and recording was deemed urgent before the designs suffered further deterioration

University of Pennsylvania Museum photo



For the ear, Cayo had a music all its own, beginning far in advance of dawn with the boastful crowing of the roosters that adorned every dooryard. As sunrise approached, their chorus was supplemented by the brilliantly clear whistles of the blackbirds. Punctuating the bird and rooster chorus were the hourly strokes of the town clock, followed by the rapid insistent calling of the convent bells to mass. Almost any hour of the day or night the gay or plaintive notes of the marimba floated up from open doorways or balconies.

I had arranged for us to take breakfasts and dinners at the local "hotel," run by a Syrian family. This was a conglomerate arrangement of leaning boards and corrugated metal, flung together with a casual disregard for the perpendicular. If walls sagged, doors were sawed off slantwise to fit the opening. The dining room, walled in gray corrugated patches, was simple and primitive with doorways looking out on the town square, the rear watertank, and the kitchen dooryard. In the yard, we could watch an accumulation of roosters, stray dogs, lean cats, and small dusky children who peered in curiously as they darted past. Here again, lack of elegance was more than made up for by the genuine friendliness and unfailing good humor of the proprietors.

Meals were generally fair and sufficient. Our first breakfast consisted of oatmeal, canned spaghetti, mashed kidney beans, and stacks of the local bread, which was white, soft, and as tasteless as several thicknesses of Kleenex; but it was edible in enormous quantities with plenty of good Australian canned butter. Since we were obediently avoiding fresh vegetables and unknown water, we all drank tea and were grateful for overboiled cauliflour, the only vegetable that seemed to be in season. Pork, beef, and liver were frequent and were well cooked and seasoned. Eggs were plentiful after the Christmas fiesta cooking was over. A rice and bean mixture and mashed beans showed up regularly at every meal. Desserts were puddings, shaved ice covered with canned milk and called ice cream, and an occasional plate of delicious slices of papaya dipped in sour orange juice.

The waitress, a large buxom Negress, spoke some English and knew how to wait on table with a tray. Nothing could budge her sluggish progress from course to course. She lived in a near-by hut. Frequently when we arrived for breakfast, a small boy would be sent from the kitchen to fetch her. After one too many mornings of this, we decided to undertake our own breakfasts on the kerosene stove at the house. Breakfast picked up in quality with fresh boiled eggs, freshly mashed peppercorns, and toasted tortillas with butter and salt. Powdered coffee did for the adults while the children made out with tea or bouillon.

Our lunches at the dig improved as our experience increased. We started off with a pale loaf, a can of cheese, a couple of cans of sardines, and perhaps a box of raisins or a can of pineapple. But we looked with envy at the lunch of Jacinto, my Mayan foreman. He always exchanged bits of lunch with us, so I soon arranged to have him provide our lunch as well as his own. This turned out to be a vast improvement. His daughter or son, accompanied by smaller neighbors, would bring the food up, hot and fresh at noon, winding up the jungle trail, giving Mayan jungle calls, which their father answered. Thereafter, lunch was a high point in the day's work, each day bringing a new savory sauce to eat with the tortillas, which were carefully wrapped in several thicknesses of embroidered napkin to keep them warm. Only the red pepper was a little too *picante* for our taste, the smallest morsel of it literally scalding the mouth and throat. From the tree in his yard, Jacinto brought luscious, sweet, juicy grapefruit, which we ate like oranges.

The people in Cayo were mystified as to why we had come just before Christmas. How could we spend Christmas so far away from home? Little did they realize that for us this was the greatest Christmas present imaginable—to be transported to another land, a land of summer and friendly faces and tinkling marimbas, far from the incessant blare of commercial Christmas carols profaned by endless repetition. They could not know how good it was to be far away from department store Santa Clauses and the merchants' clamorous exhortations.

There was no chance of getting on with the work of the expedition on Christmas day. Even Jacinto, the Mayan Indian of noble priestly ancestry, wanted this feast day with his family. So we took the day off and drove down a narrow rutty lane in search of what the day might bring. It brought bright tropic birds, mudholes deep enough to challenge even the jeep, magnificent cohune palms rising like gigantic flaring green fountains, and presently, a small village of about fourteen thatched dwellings hugging the banks of a placid green river.

We stopped to take pictures and were greeted with such friendly hospitality that we dared to ask to see inside one of the huts. The interior was cool and dark, the thatch blackened by the smoke of many fires. Dried bean pods and ears of corn and peppers hung from the cross beams. In a corner, the wife was skillfully patting tortillas into shape on a palm leaf. The corn had been soaked with lime until the outer hulls were loose. It was then washed carefully in the river and ground by hand on a stone that might have been used in the same way by the ancient Mayans. These Mayans had had a kind of Spanish Catholicism superimposed on their old religion, so this was a special fiesta day for them. In another corner of the room was a shrine decorated with flowers, bits of colored paper, and bright objects, before which a stub of candle was burning.

The man, who spoke a word or two of English, entreated us to accept the hospitality of his home and take a meal with them. We declined with genuine regret but accepted his gift of sweet lemons from the tree outside, beneath which his pigs were eagerly waiting to crunch up the lemons as they fell. As we left, his wife shyly pressed into our hands a half dozen tamales wrapped in palm leaves, as a Christmas greeting. We returned their gracious gifts as best we could with a box of raisins and the chocolate bars from our lunch. This was Christmas giving in its original and essential meaning.

Soon my real work began. Xunan Tunich, referred to in archaeological literature as Benque Viejo, is the site of an ancient Mayan palace and surrounding courts, only a tantalizing fraction of which has been excavated. Portions of the topmost structure have been exposed for many years, but one section of the eastern façade containing a stucco frieze had been re-

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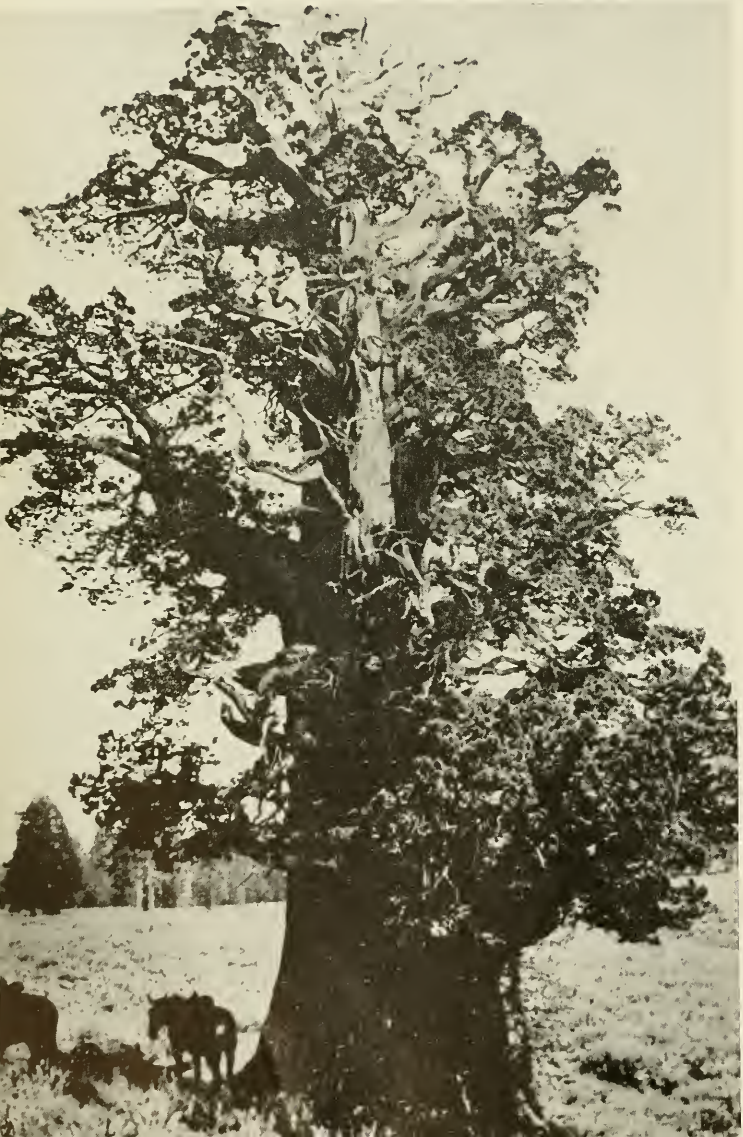
a Giant among Junipers

The contender for first place among our Junipers seems to enjoy heavy odds, for the next in line is only a little more than half as big

▼ THE GIANT BENNETT JUNIPER in Stanislaus National Forest in east-central California. This mighty Western Juniper is credited with a height of 80 feet. Its girth at breast height is 40 feet 11 inches and at ground level 57½ feet

Photograph by Clarence K. Bennett



By PHILIP FERRY

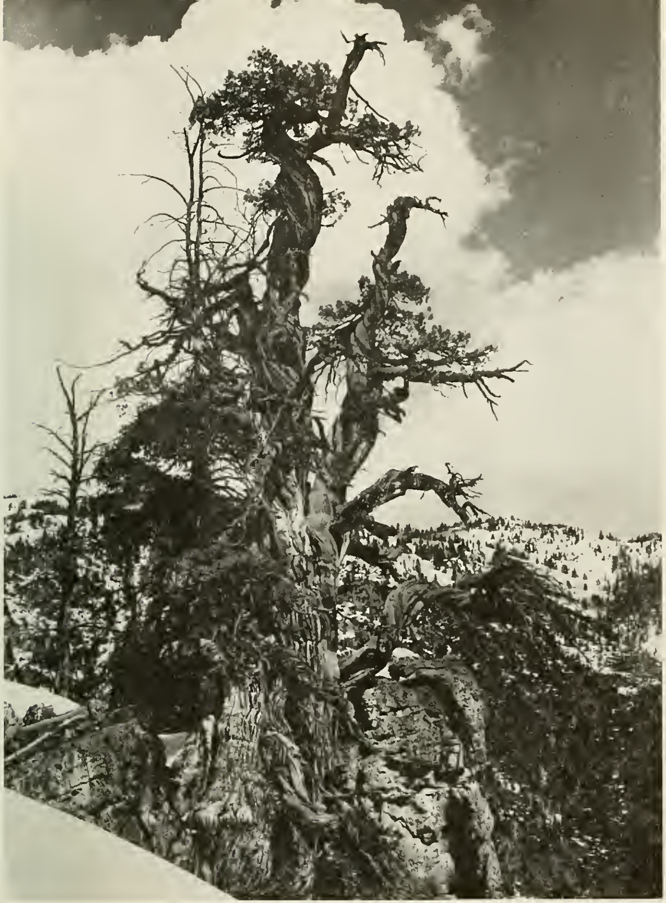
CLARENCE K. BENNETT of Hillsboro, California, who has made a lifetime hobby of juniper lore, took the accompanying photograph of a juniper that may prove to be the largest in the United States. It may conceivably be the largest ever recorded.

Mr. Bennett learned about the giant tree from men of the Forest Service while he was on the trail of another rumored colossus in the same general area. He did not find the tree he was seeking and feels that the missing prodigy, like the fish that got away, is the greatest in existence. But the tree he did find is credited with a height of 80 feet by J. R. Hall in the list of the American Forestry Association. Its circumference at breast height is given as 40 feet 11 inches in the same listing, published in the June, 1951, issue of *American Forests.*

Bennett's Juniper stands in the Stanislaus National Forest in Tuolumne County, east-central California, at an altitude of 8500 feet. It is a Sierra or Western Juniper *(Juniperus occidentalis).*

Qualification for championship among junipers might fairly embrace age as well as size. However, the estimates of age are mostly very rough. Three thousand years has been ascribed to two other trees besides this one.

Several western states have claimed the heavyweight champion among junipers, or cedars, as they are sometimes called in most of the West. Utah, Oregon, and Idaho have patriarchs that have been



Photograph by Andrew J. Senti

◀ THE LOGAN CANYON JUNIPER, in Cache National Forest, Utah. The height of this large Juniper or Red Cedar *(Juniperus scopularum)*, is given as 44½ feet, and its circumference 4½ feet above the ground is 26 feet 8 inches. As with other large junipers, its estimated age of 3000 years cannot be taken with finality

held up from time to time as the oldest and/or largest in existence. The leading contender has long been the famed Logan Canyon Juniper, which is shown in the second photograph. This Rocky Mountain red cedar *(Juniperus scopulorum)* grows on Cottonwood Ridge in Logan Canyon, Utah, at an elevation of 7300 feet. Characteristic of the species in general, it is rooted in rock and is a gnarled, twisted old Methuselah that shows the results of centuries of struggle with the elements.

The Logan Canyon Juniper was discovered in 1923 by Maurice Linford, when he and his brothers were on a hike. They exhibited a photograph of the tree to the Botany Department of Utah Agricultural College, and it was at once recognized as a very extraordinary tree. Members of the Botany Department measured the juniper and found it to be 26 feet 8 inches in circumference and 44 feet tall. The tree is hollow and has a large crack in the trunk, into which the men crawled to make borings of the heartwood. This is one of the trees whose age has been estimated at more than 30 centuries.

Red junipers are sturdy mountain fighters, and while their age limit has not been fully determined, they are known to live a very long time. A specimen cut in Idaho in 1928 showed 1618 annual rings. These trees attain their height slowly, and when rooted in rock crevices and buffeted by severe winds, which is usually their fate, their diameter likewise grows slowly. But in time, even in such exposed locations, the tree achieves a thickness of trunk that appears out of all proportion to its height.

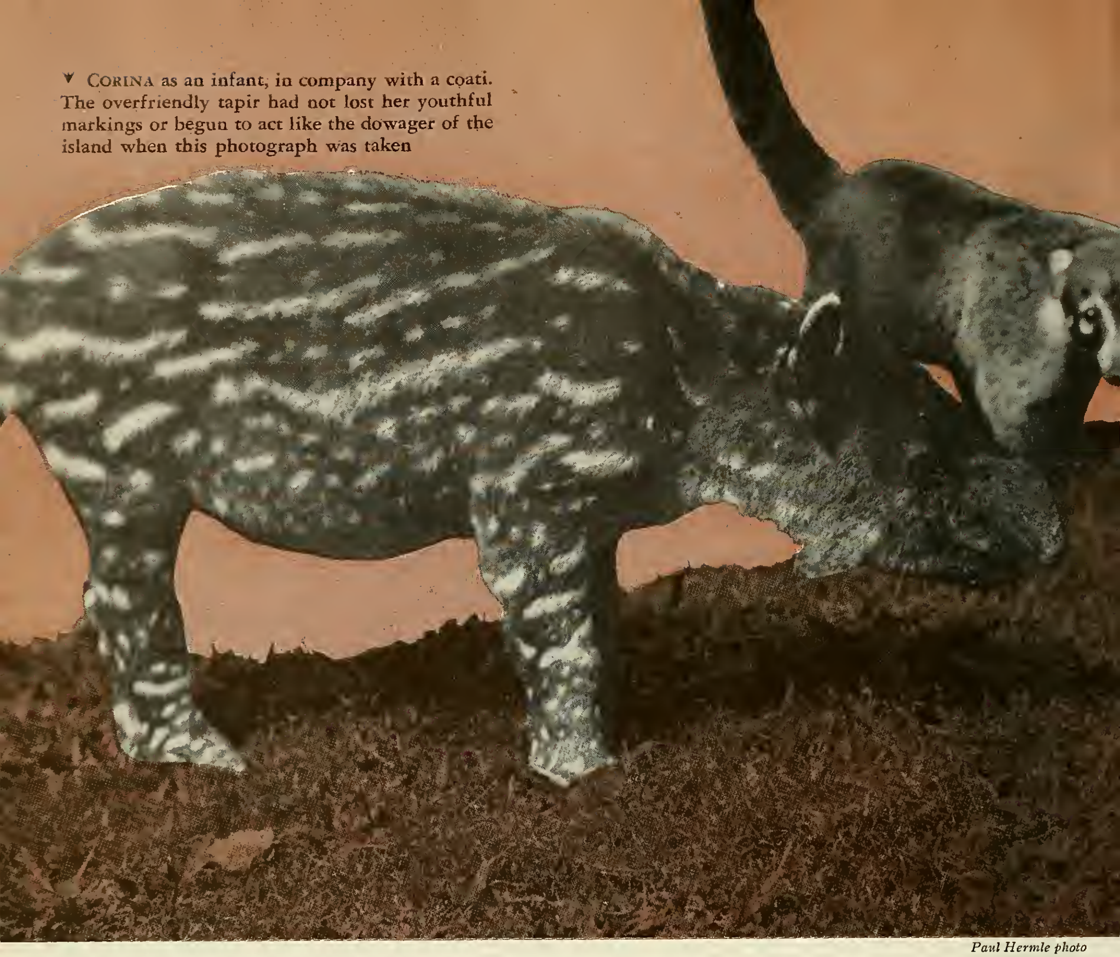
The range of the Western Juniper, to which Bennett's find belongs, is from Idaho, southeastern Washington, and eastern Oregon to Southern California, where the tree grows at high elevations in the San Bernardino Mountains. Western Junipers reach their maximum development at elevations where the Giant Sequoia, or Big Tree, begins to thin out.

Most junipers are not large trees. Commonly they are under 50 feet in height and have a trunk whose thickness can be expressed in inches. Bennett's colossus is therefore a triple-threat contender. It is a candidate for honors in bulk as well as longevity and may well be the all-time, all-around champion juniper. It stands on the slope of a volcanic ridge about eight miles from Kennedy Meadow on the Sonora Pass road, at a point two and a half miles from the Eagle Creek trail and west of the Stanislaus River.

It is rooted in good soil and watered by a stream that flows close by. The tree has the characteristic irregular open crown, beginning within a few feet of the ground; and its thick, tapering, conical trunk is typical of Western Junipers. It stands alone, but a small clump of junipers grows a few hundred feet away. While some of these are large as junipers go, they are dwarfed by Bennett's Juniper.

Until the day that Bennett finds the elusive Lost Giant he had been seeking for several years, the Stanislaus monarch must remain the king of our junipers.

▼ CORINA as an infant, in company with a coati. The overfriendly tapir had not lost her youthful markings or begun to act like the dowager of the island when this photograph was taken



Paul Hermle photo

The Lady of the Lake

Corina, the tapir, confronted her human friends with many a delicate situation when she insisted upon becoming The First Lady of Barro Colorado

By KEN STOTT, JR.

General Curator, Zoological Gardens of San Diego

CORINA was Official Hostess for the island of Barro Colorado, and it cannot be denied that she possessed many of the attributes that characterize a good one. She was unfailingly attentive, unmistakably sincere, and above all, she could find something to love in almost everyone.

Customarily, she was at the dock awaiting the arrival of the launch on Tuesdays and Thursdays, the regular visiting days. But should she fail to meet the boat, owing to an occasional oversleeping or perhaps some important bit of business on another part of the island, she made it a definite point to call at the cottage of each group of newcomers later in the day. It was in such a manner that we first made this unusual acquaintance.

My wife and I had been assigned a wooden bungalow just north of the laboratory on the brink of the hill. On two sides the cottage was hemmed in by jungle, and on another by the lab, but the fourth provided us with a vista that was incredibly wonderful. Below us stretched the mirror expanse of Gatun Lake, a part of the Canal Zone waterway, and beyond lay the sprawling, lushly forested hills of the Republic of Panama. As soon as we had unpacked, I stepped into the bathroom for a shower, leaving Peggy standing by the window staring slightly awe-stricken into the distance.

It was only a few minutes later (I had just come out of the shower) when I heard a clattering on the porch and a terrific thump against the side of the house. Immediately afterward, Peggy's voice drifted in through the closed door between the bath and the living room. My wife sounded disgruntled.

"Go away!" she ordered. "Get your big wet feet off the door and go back into the forest where you belong."

More thudding sounds, this time accompanied by a shrill bleat.

"No! You can't come in . . . and for heaven's sake, get your dirty nose off the window."

Towel-draped and dripping, I ran into the room to discover that the nose in question was not only dirty but excessively large, and it was pressed against the pane in the door like that of a child against a candy store window. Had it not been for the dimensions of the nose and the grotesque, ungainly creature to which it belonged, the scene might have taken on a wistful quality, but under the circumstances, nothing could have been further from the truth.

The dirty nose belonged to a half-grown Baird's Tapir; a lady Baird's Tapir it was and a very dirty one all over. She was standing on the front porch with her hind feet firmly implanted on the floor and her front feet propped against the closed door. Alternately, she worked at the doorknob with her nose and mouth, and upon failing to turn it, peered in agonized frustration through the window, squealing lustily while her piggy little eyes watered in a manner that was both profuse and unattractive. Her ears, great round things with cream-colored edges, turned back and drooped.

"She has mange," Peggy observed tactlessly.

As a matter of fact, she didn't. With the exception of the hairy tapir of northwestern South America, all tapirs are notoriously short-haired. Often the growth of hair is so sparse that the black, shiny skin beneath shows through, and this was true of the brown-coated Baird's Tapir that now stood before us. But while I could defend the condition of her coat, I could not deny the existence of myriads of ticks about her neck and ears and the resulting sores.

The tapir's visit was obviously a matter of social obligation, but it was equally obvious that Peggy did not feel up to receiving our guest.

"Don't be rude," I admonished. "Ask her in."

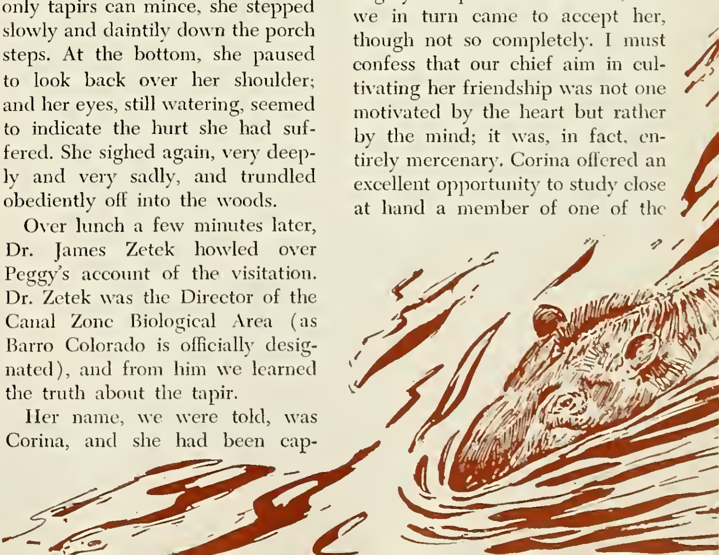
Peggy glared at me coldly and turned to face the tapir again. "Call again some other time . . . after we're settled."

The tapir, sensing defeat, heaved a horrible sigh and moved back from the door. Then, mincing as only tapirs can mince, she stepped slowly and daintily down the porch steps. At the bottom, she paused to look back over her shoulder; and her eyes, still watering, seemed to indicate the hurt she had suffered. She sighed again, very deeply and very sadly, and trundled obediently off into the woods.

Over lunch a few minutes later, Dr. James Zetek howled over Peggy's account of the visitation. Dr. Zetek was the Director of the Canal Zone Biological Area (as Barro Colorado is officially designated), and from him we learned the truth about the tapir.

Her name, we were told, was Corina, and she had been captured by natives near the village of Maje on the Rio Chepo o Bayana in eastern Panama. She had been just a baby at the time and still had the white spotting and striping characteristic of all infant tapirs. When her capture had come to Dr. Zetek's attention, he had spared no effort to acquire her for his island sanctuary. At about the same time, he had obtained an eleven-month-old fawn, Chevita by name, and the two had been set loose in the clearing around the laboratory. They had become fast friends, Chevita and Corina, and were often to be seen in each other's company as they wandered through the forest. Wild tapirs and deer lived naturally on Barro Colorado but were extremely shy, partly nocturnal, and rarely encountered. "But," Dr. Zetek explained with evident satisfaction, "Corina and Chevita have changed all that."

During the ensuing weeks, we came to know the two strange companions well, particularly Corina, whose friendship was more easily won. Chevita never came to trust us thoroughly, and I am certain that she came around us only to be near Corina, not because she enjoyed our company. Any sudden movement or loud noise would send the rust-colored fawn bounding off into the forest; and after such a departure, we seldom saw her again for the remainder of the day. But Corina found us thoroughly acceptable at all times, and we in turn came to accept her, though not so completely. I must confess that our chief aim in cultivating her friendship was not one motivated by the heart but rather by the mind; it was, in fact, entirely mercenary. Corina offered an excellent opportunity to study close at hand a member of one of the



most remarkable animal families on the face of the globe.

The tapir clan is a distinguished one, not so much for what it is today but for what it has been in the past and because of its relationships with other groups of animals. Actually, the clan is currently at a low ebb. There are only four existing species, and these are restricted chiefly to tropical climes. Three are native to the New World and one, the saddle-backed tapir, is found in the swampy jungles of southeastern Asia. At one time, thousands of years ago, tapirs were an important part of the animal kingdom. Not only were they well represented numerically, but there was considerable variety and the family enjoyed wide distribution. Within the United States their fossil remains have been unearthed from California to Florida, and formerly they occurred in Europe as well. Now, of course, they are much more limited geographically, and nowhere within their present range are they to be considered plentiful.

Although the term is apt to grow tiresome owing to overuse, tapirs can best be described as "living fossils," for the surviving species show little change from those that existed in the Pliocene, years ago. Tapirs now as then are characterized by their somewhat rhinoceros-proportioned bodies and their moderate dimensions (about those of a blue-ribbon sow or a Shetland pony). Their legs are short and stocky, and their broad-crowned teeth are designed chiefly for grinding vegetable matter. Whether or not the ancestral tapirs possessed the long prehensile snouts so typical of their descendants is a point for conjecture, since fossil skulls can only begin to indicate the contours assumed by the flesh that once covered them.

Tapirs belong to the group of animals known as the Perissodactyla, or "odd-toed" hoofed mammals. This "odd-toed" business refers to the number of toes, not the nature of them, and serves to distinguish the animals to which it is applied from the cloven-hoofed or "even-toed" creatures like deer, cattle, giraffes, and camels. The order Perissodactyla now includes the tapir family and two others: the rhinos, whose relationship to the tapirs is fairly apparent, and the horses, whose relationship is not. The horse, with only one functional toe (having lost all of the others during evolution) is the most specialized and highly developed of all; the three-toed rhino comes next; and the tapir with three toes on each front foot and still four on each hind foot stands as the most primitive, the least modified of the lot.

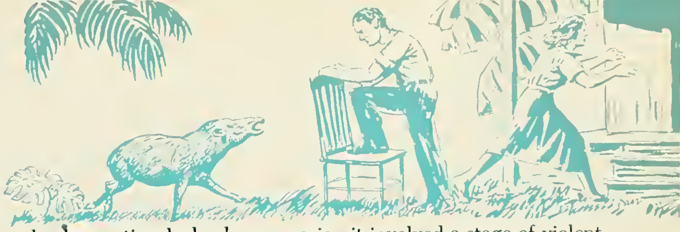
Here again is confirmative support for the contention that the tapir is a living fossil. Temperamentally, however, Corina was tireless in her efforts to enter the modern world of man.

Totally uninhibited, she felt compelled to express any impulse she might have, and no amount of discouragement seemed to faze her. Although she appeared quite aware of a negative response from one of her human friends and was even more sensitive to a scolding, her dim little mind seemed incapable of controlling the compulsions of her great brown body. All the while, it was easy to imagine that her mournful eyes were saying: "I'm not really like this; I just can't help myself."

Often as we sat on the laboratory porch, watching some creature in the treetops or bringing our notes up to date, she would slip quietly up behind us and surprise us with a playful nip on the ankle, or place her wet rubbery nose against the

⮟ At this age, Corina had scarcely begun to show the long snout so characteristic of the adult

Paul Hermle photo



neck. The unbounded affection she felt was never mutual; and as we came to know her better, we loved her less.

A persistent, petulant, and overzealous female she was, and when she felt in the mood for attention, she never gave up until she got it. If we pretended to ignore her, her playful nips would become increasingly less playful until eventually we were forced to forget about the birds and the beasts for the moment and concentrate on Corina.

She doted on being petted, and when we scratched behind her ears, she became ecstatic with joy. Her eyes rolled upward, and she closed the eyelids until only slits remained. If we continued—and we had little choice in the matter—her knees began to tremble and her whole body wavered alarmingly. Then all at once she would drop to the ground like a collapsed balloon and roll over on her back with her legs flailing in all directions.

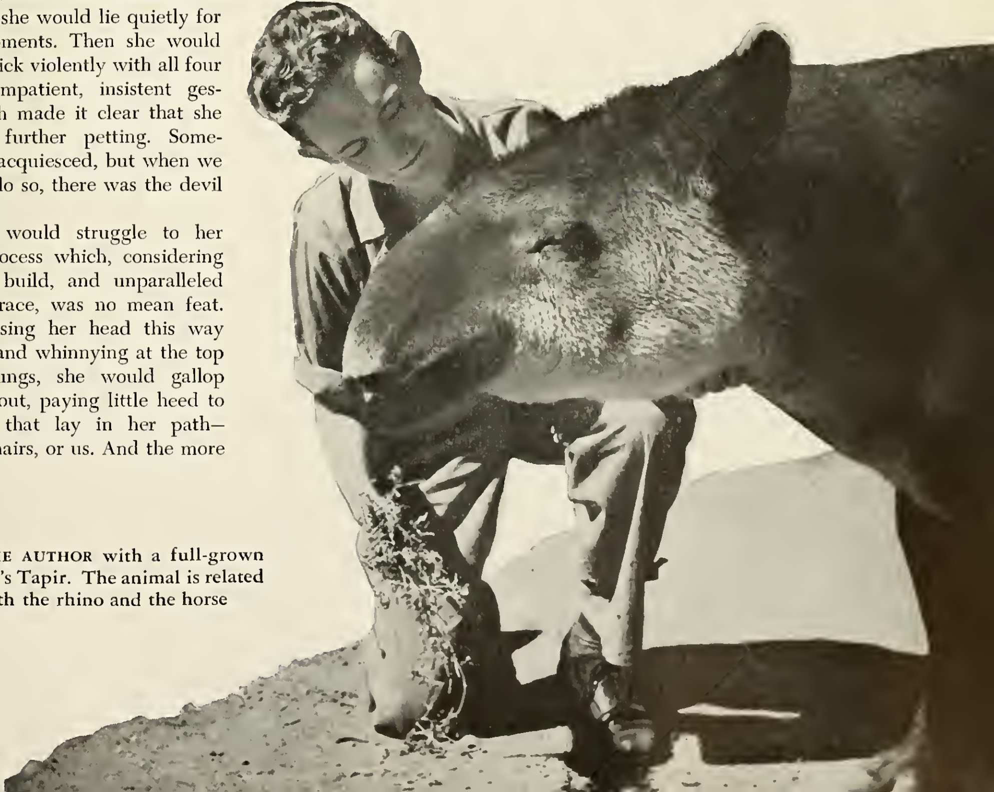
When we became weary of Corina's whims and ceased our caressing, she would lie quietly for a few moments. Then she would begin to kick violently with all four legs—an impatient, insistent gesture which made it clear that she expected further petting. Sometimes we acquiesced, but when we failed to do so, there was the devil to pay.

Corina would struggle to her feet—a process which, considering her size, build, and unparalleled lack of grace, was no mean feat. Then, tossing her head this way and that and whinnying at the top of her lungs, she would gallop wildly about, paying little heed to anything that lay in her path—shrubs, chairs, or us. And the more she ran, the less rational she became. Her hysterical cavortings, which had been aimless at first, gradually took on purpose, and the hostile resentment she felt toward our indifference grew overpowering. Then she would charge.

If we had time, we would run into the lab, but often we could only scramble up on our chairs and attempt to keep our legs and feet out of reach. She would roll toward us with mouth agape and saliva dripping from each side, and when she failed to make contact, she would run in a circle before repeating the charge. It was during such a lull that we always made our escape into the laboratory, and there we would wait for Corina to regain her composure.

The length of time required for recovery varied, but on each occasion it involved a stage of violent frustration, during which she would bite or butt anything within reach. Then came a period of pathetic squealing at the door; and finally, complete (but only temporary) resignation. Dejected and drooping, she would amble slowly away, leaving us to wonder why and how this particular living fossil had managed to survive.

But Corina was not always so objectionable. There were times, as when we explored the dense rain forests of Barro Colorado, that we found her company quite comforting. The jungle, whether filled with squawks and squeakings as it always was in the cooler parts of the day, or silent as death during the warmer hours, was a strange and awesome place; and the presence of a familiar being (even



➤ THE AUTHOR with a full-grown Baird's Tapir. The animal is related to both the rhino and the horse

Corina) who knew and understood its depths, contributed somehow to our peace of mind, even though the tapir was no more at ease there than we were.

Regardless of her size and forest origin, Corina was constantly nervous and on the alert. Her cream-rimmed ears trembled at each soft noise, and she paused frequently, standing stock-still in the trail, when any sound or sight disturbed her. Often as she stood there, she would lift one front leg, bringing to mind some nightmarish sort of bird dog.

When she became thoroughly frightened, she would whirl in her tracks and come barreling back down the trail toward us, whistling like a runaway steam engine. Generally we had no choice but to dive into the vegetation on one side or the other and give her the right of way. She would pass us without a glance and keep on running full tilt until she reached the clearing.

Prior to our excursions with Corina into the hilltop forests of Barro Colorado, I had thought of tapirs primarily as creatures of the water, for they are unquestionably best adapted for such an environment. They are excellent swimmers, and they can move their great, thick-skinned bodies through the water with only the tip of the long flexible nose showing above the surface. A large part of their diet is provided by plant life growing along lakes or rivers, and I have been told that they feed also on vegetation that grows beneath the surface of the water.

But Corina could traverse the treacherous up-and-down trails of the jungle rapidly and quietly, and her feet were as well suited for use on muddy trails as they were in swamplands. When exposed to the pressure exerted by the weight of her body after each step, the burdened foot would spread and sink into the mud; but when the pressure was removed, it would decrease in girth and she could extricate it quickly and easily, despite the sucking action of the moist soil. Usually her pace was slow, but when the occasion demanded, she could move like the wind (a rather large wind, at that!).

Dr. Zetek told us that the wild tapirs on the island spent the greater part of the day either in the water or in the vegetation along the lake margin but that at night they were often encountered on the hilltops and far from the water. It was only at times such as these that tapirs proved dangerous, and even then the menace they provided was entirely unintentional. In their fright they sometimes ran toward an intruder rather than away; and being run down by a tapir is an unpleasant experience, regardless of the animal's intent.

The Baird's or Central American Tapir is not the only one that temporarily forsakes the lowland marshes. The Common or Amazon Tapir frequently makes inland and upland trips of short duration, and the little-known Hairy Tapir exists only high in the Andes Mountains of Colombia, Ecuador, and perhaps Peru. It has been recorded at altitudes above 13,000 feet. So, despite any erroneous preconception I may have had, tapirs are far from confined to lowland waterways or their immediate vicinity.

In some ways Corina was at better advantage out of water than in it. We learned to our great surprise that, when Corina became unbearable, our only sure-fire outdoor means of escape lay not on land but of all places in her own element!

It was on the day of our first *cayuco* (dugout) trip that we made this happy discovery. As we left the cottage for the boat landing below, Corina emerged from the forest and tripped (quite literally, as was her wont) toward us. As usual, she exuded oppressively good spirits and beads of oily perspiration. We shoved her harshly away and told her bluntly that we did not wish her company on the *cayuco* trip. The thought of a half-grown tapir in a flimsy native dugout may sound fantastic, but I have no doubt that, if given the slightest encouragement, Corina would have given it a fair try.

She ignored our beratings as though they had never been offered and rumbled along behind us as if we had welcomed her with open arms. Upon reaching the dock, Peggy and I climbed into the boat without so much as a word to the tapir.

Corina, standing on the wharf, let out a heart-rending bleat. Forsaken, she made a pathetic sight as she watched us pull away. Then suddenly a horrible gleam entered her eyes.

She peered down over the edge of the pier for a moment. Then with enviable abandon, she stepped off. She hurtled through the air for a second or so, then hit the surface with a tremendous splash.

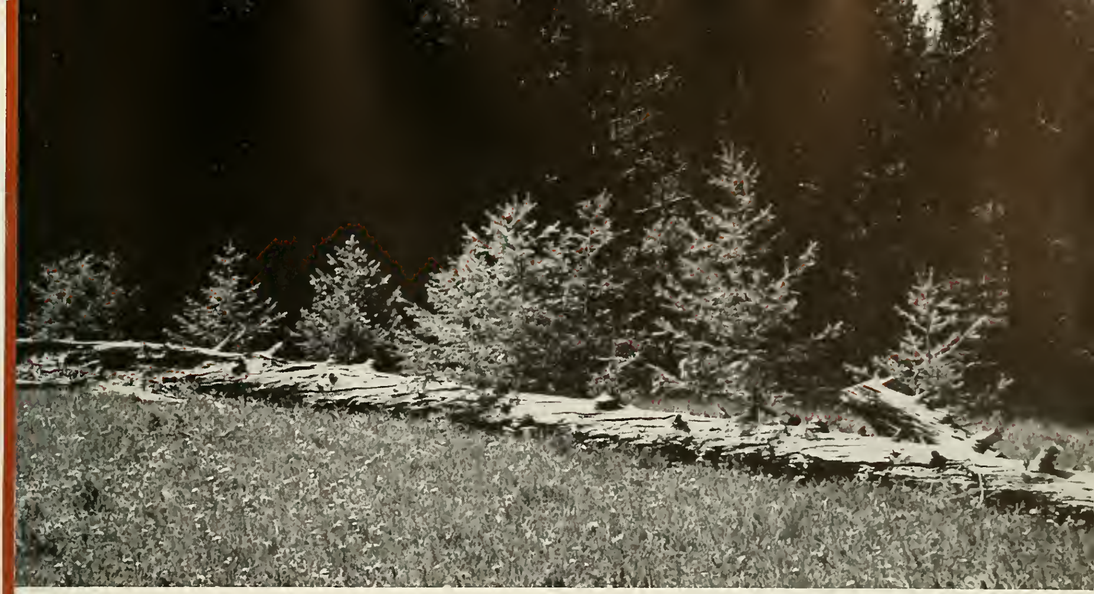
A mushroom of water erupted, and all the near-by *cayucos*, including ours, pitched violently. Gradually the wavelets she had created subsided, but there was no sign of Corina.

Perhaps she had plummeted deep into the mud on the lake bottom, or possibly she had become impaled on one of the many sharp stumps beneath the surface. We sat considering the possibilities and the mixed blessings.

Then Corina came to the surface. Seemingly undisturbed by her experience, she tossed her head about happily and wiggled her feet in a sort of aberrant dog-paddle. As a lady of the lake, she constituted an unreasonable facsimile.

I began paddling for all I was worth—not toward her, needless to say, but in the opposite direction—and wonder of wonders, the *cayuco* began to slip smoothly away from the pursuing tapir. Although Corina was now in her element, so was the *cayuco*, and we swiftly outdistanced her.

Corina watched us forlornly for a while; then she turned about and made her way slowly toward the shore. At last we had discovered a way to elude her! Or perhaps it was merely that there comes a time when even tapirs know when they're not wanted.



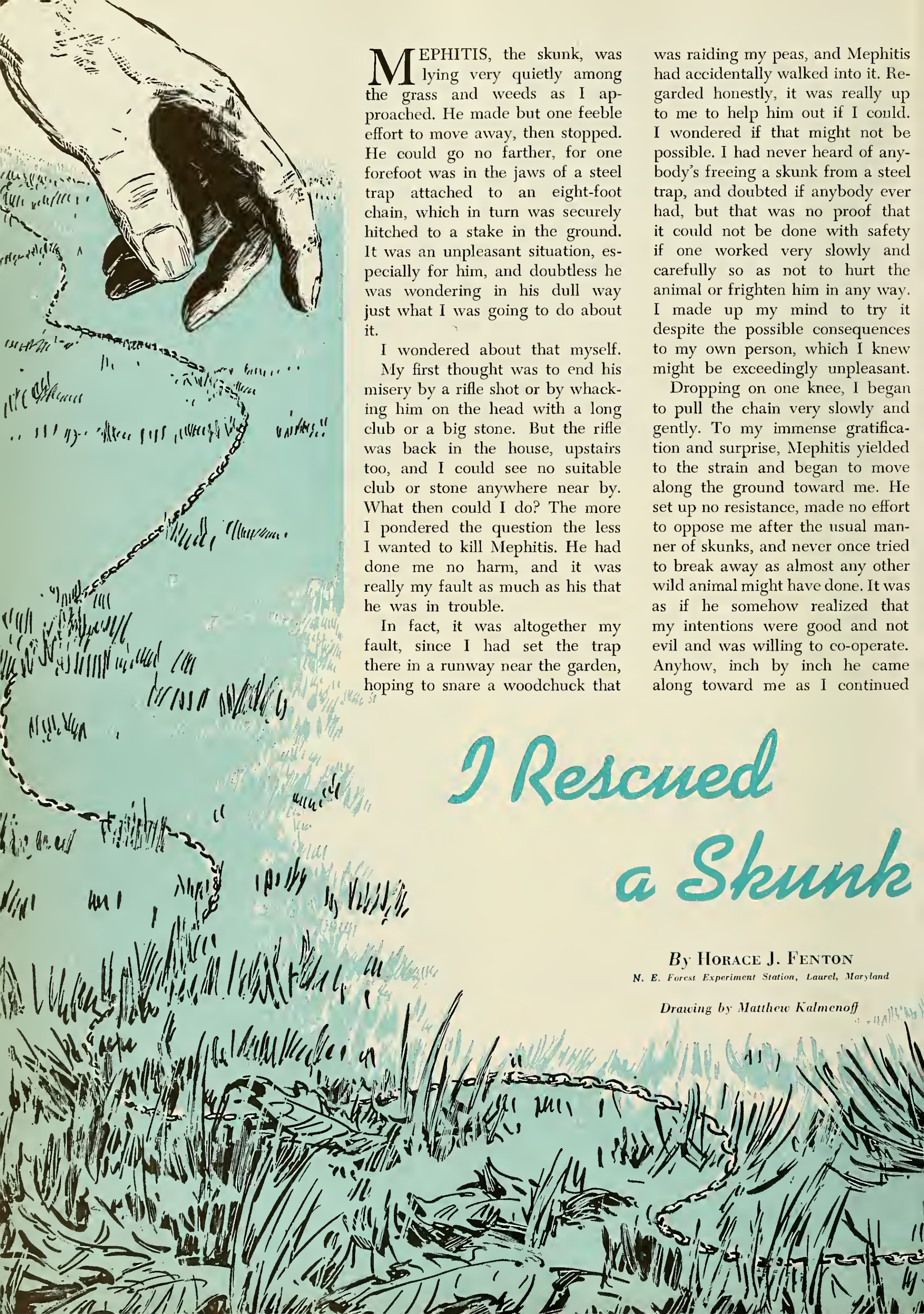
▲ NOT ONE but many seedlings have sprung up along the shady side of this fallen evergreen. Possibly the log provides a root-run for the seedlings where they would be free from competition with the voracious roots of grasses. Also, the log is no doubt absorbing rain and releasing it gradually, along with the nutrient products of decay. But perhaps the most important factor is the shade that these seedlings may need for the first year or two

▼ UNDER NATURAL CONDITIONS, the fertility of the forest soil is renewed through the falling of leaves and the ultimate disintegration of the trees themselves. Where trees are cut for timber, the nutrient elements are not returned to the soil. We have yet to learn the extent to which we may have to replace these elements through the addition of fertilizing materials and whether it may be economical to attempt to do this

The King is dead Long Live...

Rebirth of a forest is a continuous process under natural conditions

By A. L. CLARK



I Rescued a Skunk

By Horace J. Fenton

N. E. Forest Experiment Station, Laurel, Maryland

Drawing by Matthew Kalmenoff

MEPHITIS, the skunk, was lying very quietly among the grass and weeds as I approached. He made but one feeble effort to move away, then stopped. He could go no farther, for one forefoot was in the jaws of a steel trap attached to an eight-foot chain, which in turn was securely hitched to a stake in the ground. It was an unpleasant situation, especially for him, and doubtless he was wondering in his dull way just what I was going to do about it.

I wondered about that myself. My first thought was to end his misery by a rifle shot or by whacking him on the head with a long club or a big stone. But the rifle was back in the house, upstairs too, and I could see no suitable club or stone anywhere near by. What then could I do? The more I pondered the question the less I wanted to kill Mephitis. He had done me no harm, and it was really my fault as much as his that he was in trouble.

In fact, it was altogether my fault, since I had set the trap there in a runway near the garden, hoping to snare a woodchuck that was raiding my peas, and Mephitis had accidentally walked into it. Regarded honestly, it was really up to me to help him out if I could. I wondered if that might not be possible. I had never heard of anybody's freeing a skunk from a steel trap, and doubted if anybody ever had, but that was no proof that it could not be done with safety if one worked very slowly and carefully so as not to hurt the animal or frighten him in any way. I made up my mind to try it despite the possible consequences to my own person, which I knew might be exceedingly unpleasant.

Dropping on one knee, I began to pull the chain very slowly and gently. To my immense gratification and surprise, Mephitis yielded to the strain and began to move along the ground toward me. He set up no resistance, made no effort to oppose me after the usual manner of skunks, and never once tried to break away as almost any other wild animal might have done. It was as if he somehow realized that my intentions were good and not evil and was willing to co-operate. Anyhow, inch by inch he came along toward me as I continued to pull the chain. After half an eternity, so it seemed, there he was almost under my very nose, and my two hands were on the trap.

It was a most ticklish situation, and I knew it. No skunk ever had a better opportunity to show what he could do than had Mephitis at that moment, with my face hardly more than two feet from his. But he refrained, and I am confident that it was wholly because up to that moment I had neither hurt him nor made any sudden motion calculated to frighten him.

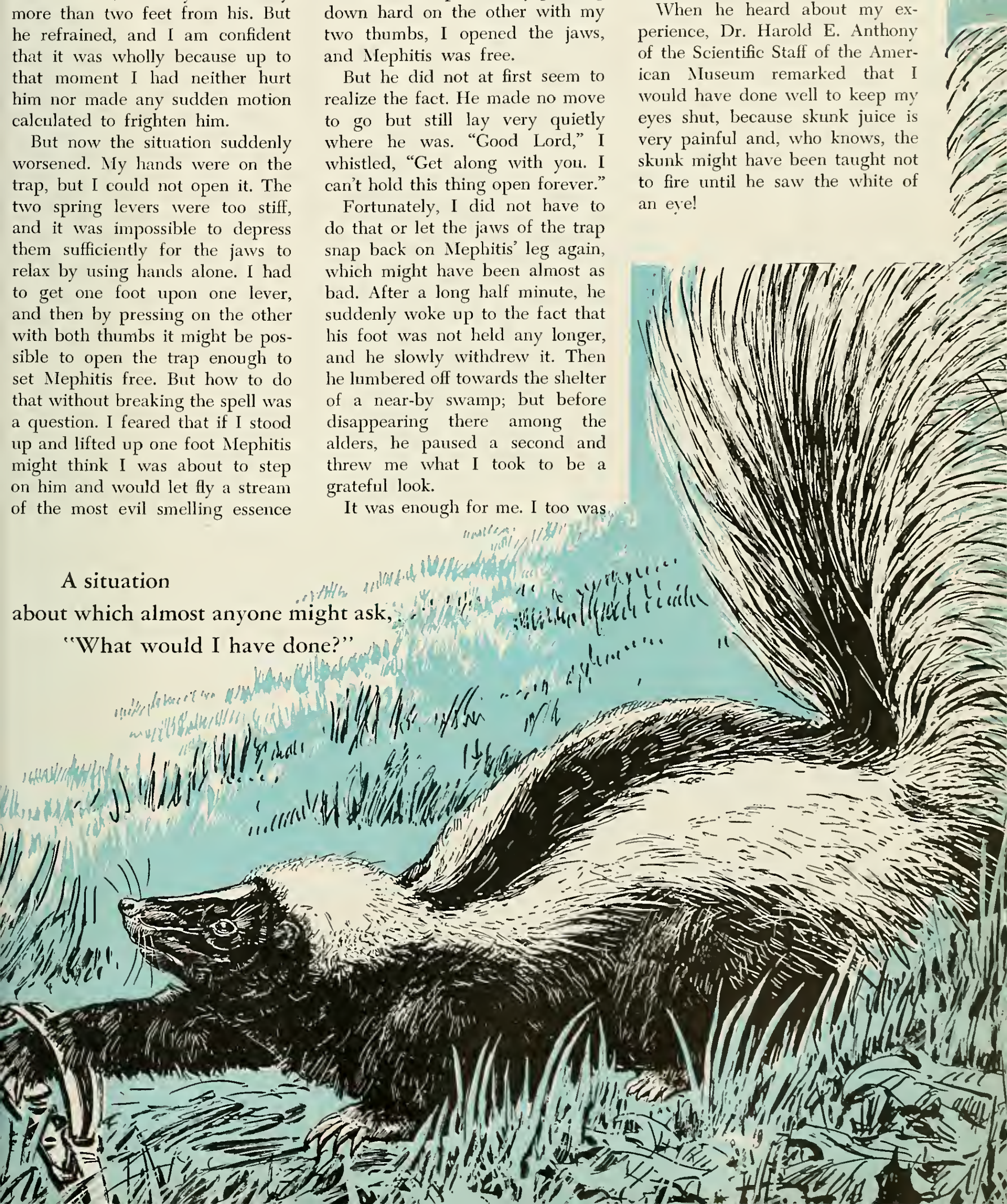
But now the situation suddenly worsened. My hands were on the trap, but I could not open it. The two spring levers were too stiff, and it was impossible to depress them sufficiently for the jaws to relax by using hands alone. I had to get one foot upon one lever, and then by pressing on the other with both thumbs it might be possible to open the trap enough to set Mephitis free. But how to do that without breaking the spell was a question. I feared that if I stood up and lifted up one foot Mephitis might think I was about to step on him and would let fly a stream of the most evil smelling essence ever made. I would then be *persona non grata* in the neighborhood for some time. No, the fewer motions the better. So while still in my cramped kneeling position I very slowly wriggled my left foot forward, inch by inch, until finally the toe of my boot was on one lever of the trap. Then by pressing down hard on the other with my two thumbs, I opened the jaws, and Mephitis was free.

But he did not at first seem to realize the fact. He made no move to go but still lay very quietly where he was. "Good Lord," I whistled, "Get along with you. I can't hold this thing open forever."

Fortunately, I did not have to do that or let the jaws of the trap snap back on Mephitis' leg again, which might have been almost as bad. After a long half minute, he suddenly woke up to the fact that his foot was not held any longer, and he slowly withdrew it. Then he lumbered off towards the shelter of a near-by swamp; but before disappearing there among the alders, he paused a second and threw me what I took to be a grateful look.

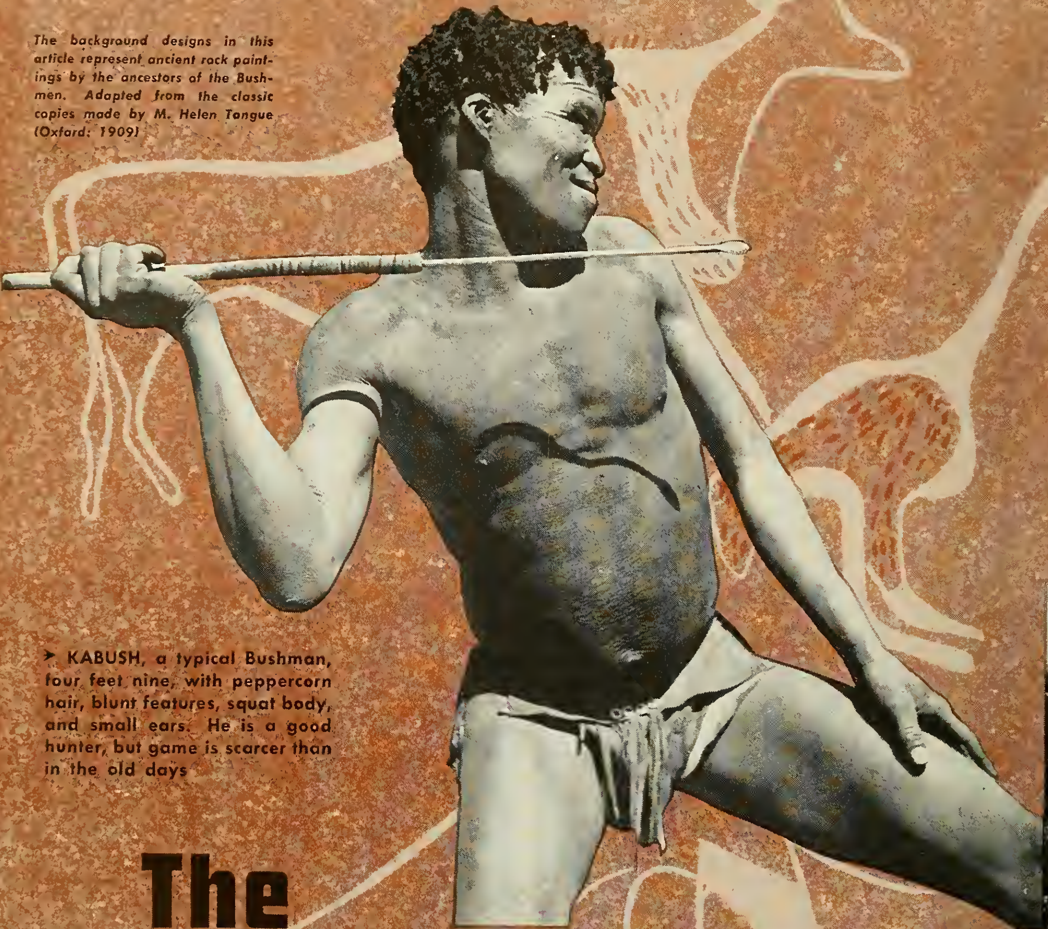
It was enough for me. I too was grateful for his restraint. I was glad to have been able to set him free with no disagreeable result. It proved to me conclusively what I have long maintained, that our common skunk is by nature a very inoffensive animal, one that will neither bite nor spray except under great provocation.

When he heard about my experience, Dr. Harold E. Anthony of the Scientific Staff of the American Museum remarked that I would have done well to keep my eyes shut, because skunk juice is very painful and, who knows, the skunk might have been taught not to fire until he saw the white of an eye!



A situation
about which almost anyone might ask,
"What would I have done?"

The background designs in this article represent ancient rock paintings by the ancestors of the Bushmen. Adapted from the classic copies made by M. Helen Tongue (Oxford: 1909)



➤ **KABUSH, a typical Bushman, four feet nine, with peppercorn hair, blunt features, squat body, and small ears. He is a good hunter, but game is scarcer than in the old days**

The Bushmen of the Kalahari

By I. SCHAPERA*

Professor of Anthropology, University of London

Illustrated with photographs by **CONSTANCE STUART**

from Black Star

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* Dr. I. Schapera was born in Namaqualand, South Africa, in 1905, and is the author of *The Khoisan Peoples of South Africa*, which is the standard work on the Bushmen and the Hottentots. He studied anthropology at the Universities of Cape Town and London and made numerous field-expeditions to the Bechuanaland Protectorate from 1929 onwards. He has also written several volumes on law, the family, land tenure, and labor migration among the Tswana tribes. He taught at the University of Cape Town from 1935 to 1950 and was visiting Professor of Anthropology at the University of Chicago in 1948. He is now Professor of Anthropology at the University of London.—Ed.

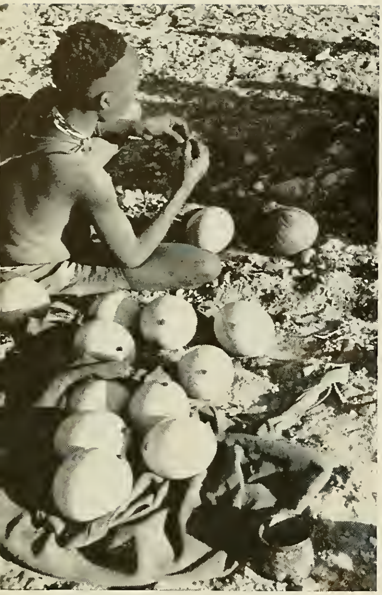
Intimate glimpses of a people born to a hard life, who show themselves to be resourceful, untiring, and courageous in adversity

IN 1931, while doing field work in the eastern parts of the Bechuanaland Protectorate in South Africa, I was invited to accompany a brief expedition into the Kalahari Desert. Its aim was to investigate the status and treatment of a people known as the Kgalagadi, who were reputed to be the serfs of the Kwena tribe.

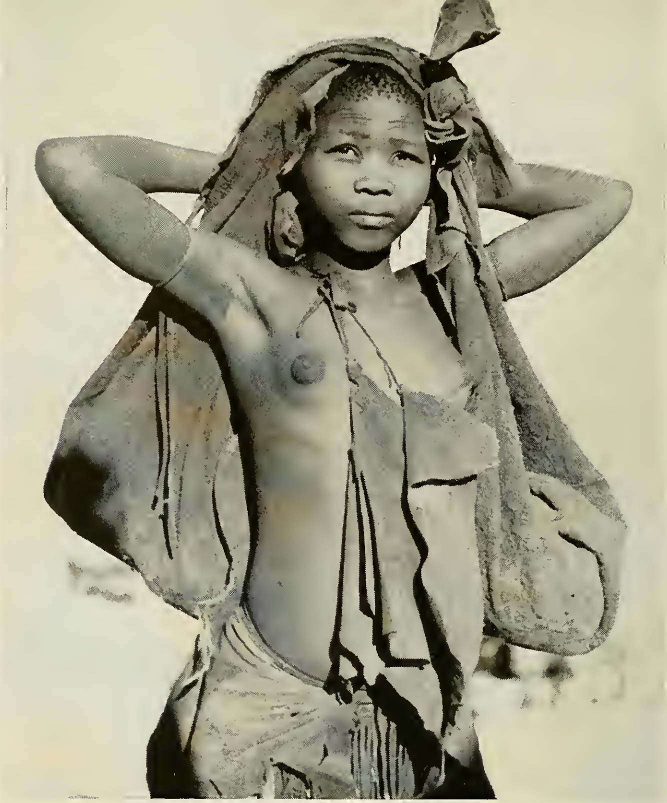
When we reached the village that was to be studied, we found the inhabitants greatly excited. A lion had recently been killing their calves; a trap gun had been set, and during the night it had been heard to go off. The men—some 40 in all, armed with old rifles of various makes, clubs, axes, and spears, and with a number of dogs —were now going along to see what had happened. We had little option but to accompany them; they were certainly in no mood to stay behind and serve as informants.

At the tree where the gun had been set, the paw mark of a lion was clearly visible in the sand, and close to it some spots of blood. Scouting around, the natives soon traced the direction of the spoor. One of them, a Bushman magician living in the village, thereupon took charge. He had brought with him a large *sekaname* bulb (*Urginea sanguinea*) and a goat's horn filled with a sooty ointment (*tshitlhò*) compounded from many different ingredients. With his fingers he smeared some of the ointment on the bulb, which he placed upon the the lion's paw mark. Each of the men, in turn, now brought and placed his weapon on the

▼ **ON THE MARCH. The people carry with them all their worldly possessions, which are extremely few**



▲ **OSTRICH EGGSHELL WATER BOTTLES.** The true desert dwellers of the tribe do no farming and are on the move most of the time. Hence the importance of a portable water supply in their Kalahari homeland



▲ **CARRYING HER OSTRICH EGG WATER BOTTLE** in a skin sling on her back, this young Bushman girl is ready for a long march in search of game with her elders

same mark, and the magician rubbed it with the bulb. He then bundled all the weapons together and, placing their butts on the lion's print, tilted them over in the direction taken by the spoor. As he did so he said, "*A di bolayê* (Let them kill)," and the men around him repeated the phrase.

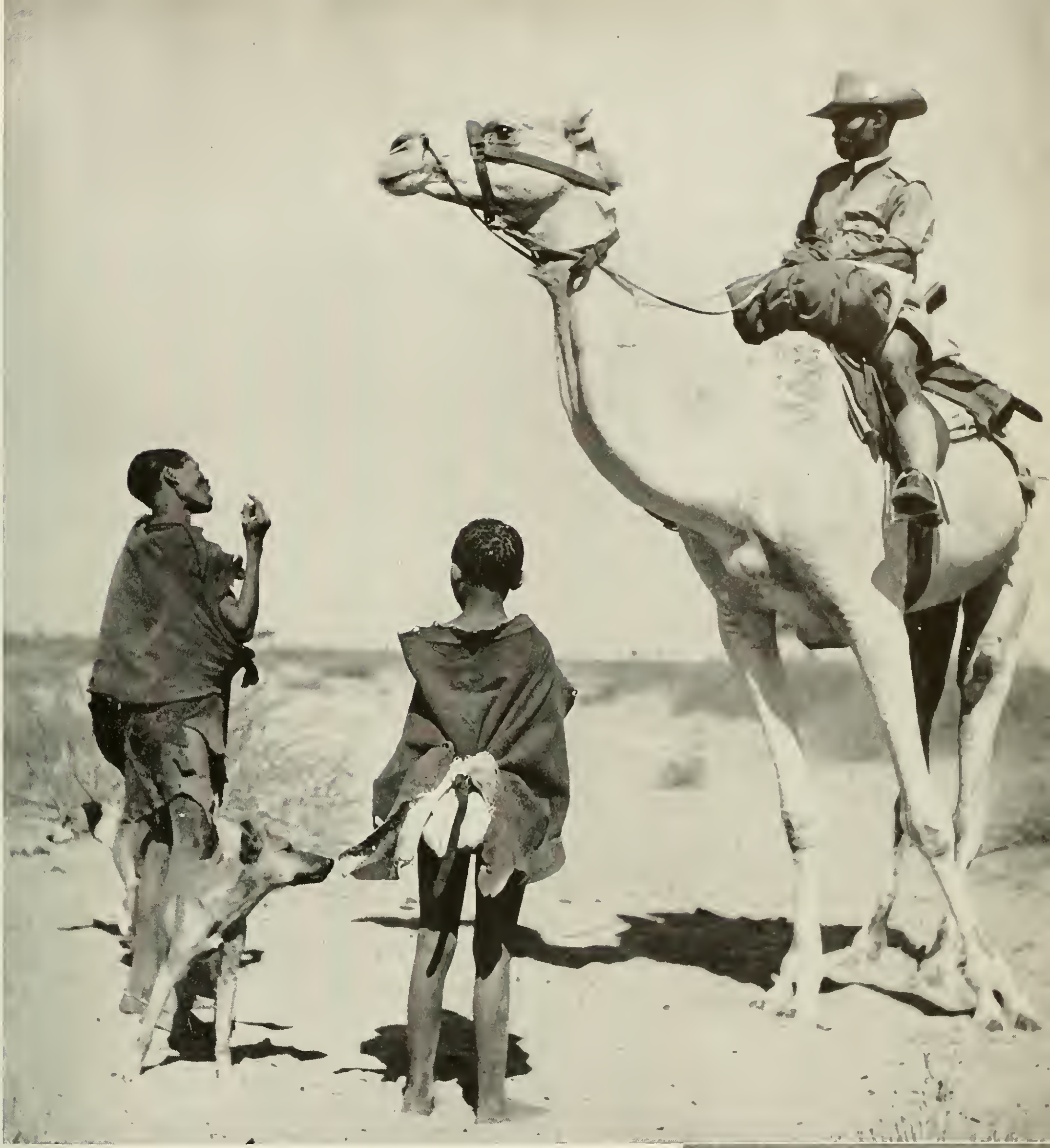
The magician returned the weapons to their owners and asked for three of the dogs. When they were brought, he smeared ointment on the palate, teeth, and nostrils of each one. Next, he again anointed the bulb and replaced it on the paw mark. He then handed the horn to another Bushman (whom we afterward discovered to be the leading tracker of the party). Finally, he plucked two twigs from a *moretlwa* bush (*Grewia cana*) and planted them in the ground to form a crossed arch over the bulb.

Calling by name on a few of the men (they were the more skillful hunters), he had them tread on the bulb, one by one. They carefully stepped over the arch so as not to disturb it and marched a few paces ahead, where they stood still without looking back. The other men, and our own party of four, then did the same.

This concluded what we were afterward told was the magical ceremony of "strengthening the hunt."

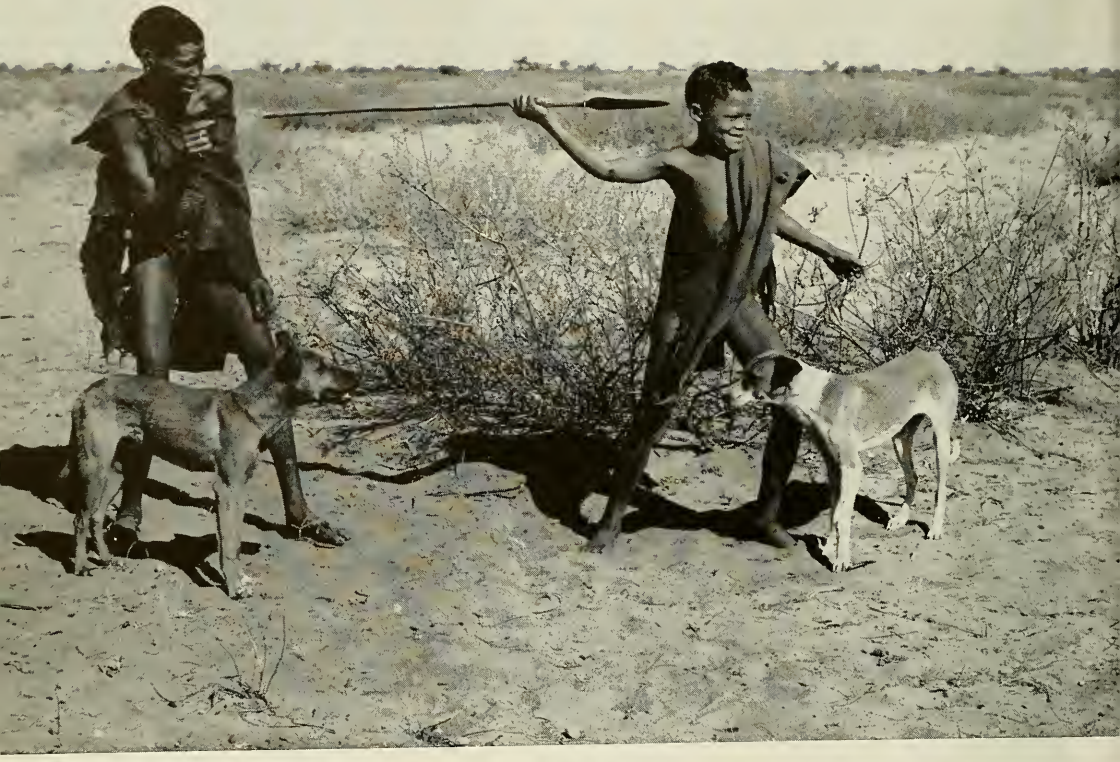
Two of the Bushmen now took the lead and, leaving the bulb under the arch, everybody followed. The slightly bloodstained spoor led across country in a sort of arc and appeared to present little difficulty to our guides. At times they even quickened their pace to a run, so sure were they

▼ **THESE FRAGILE CONTAINERS** are sometimes all that stand between the Bushmen and death from thirst in their arid land. The people scratch primitive designs on them



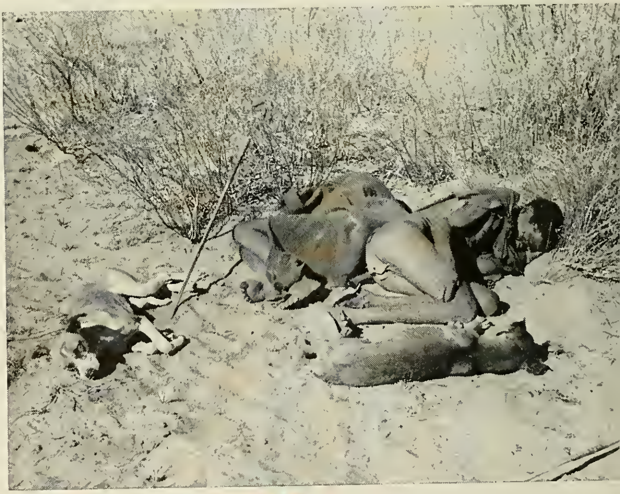
▲ **THE BECHUANALAND POLICE** patrol the desert on camels. The Bushman has his own laws and finds it hard to understand the European code

of its direction. They went ahead alternately, occasionally pausing to consult together. The others followed close behind in a disorderly group, apparently unafraid of a surprise attack; but they kept their voices low. We, too, had been asked at the beginning not to talk loudly and not to mention lions, since it is taboo to refer by name to the animal being hunted. Every marked indication of the spoor was pointed out to us—footprints, spots of blood, broken twigs, fresh droppings of dung, and, once, a slight depression in the sand showing



▲ **A FATHER** teaching his son how to throw a spear. All Bushmen have lean hunting dogs

➤ **WHEN TIRED,** the hunters frequently scoop out a place for themselves in the sand and go to sleep with their dogs



where the lion had rested. It was a graceful gesture, which enabled us to form some idea of how animals are tracked.

After winding in and out of the deep sand and dense bush for a couple of hours, we reached a small cattle post. Here we learned that during the night another calf had been seized by a lion. The carcass had been found a few hundred yards away, and its meat was at that moment being cooked. One of our men asked for some to eat, but refrained when the magician told him that he would then have to stay behind. Meanwhile, an animated discussion was taking place about the identity of the lion that had killed the calf. The Bushmen maintained that it was the very animal we were following, and their opinion was soon accepted.

The trail was again taken up, and we twisted through the veld for about another mile and a half. Suddenly one of the men in front pointed excitedly to the left, and a moment later a dog dashed off in that direction. We heard it barking in the distance and rushed toward it. Shortly afterward, it was again heard over to the right, and we swung round accordingly.

By now the other dogs had caught up with the leader and brought the lion to bay under a tree. As we ran up, we could hear its angry grunts, mingled with the barking of the dogs. It soon became visible at the other end of an open glade. The leading native, planting himself behind a forked tree about 50 yards away, took careful aim and shot it in the right shoulder. Two more shots at close range from a shotgun put an end to it.

The natives all rushed up to the body and started to beat it with the butts of their weapons, shouting out jubilantly, "*Kgomo tseo, kgomo tseo!* (Those cattle, those cattle!)." Then followed a short chant of victory, and the men sat down with visible enthusiasm to talk over their happy success. The shot from the trap gun had merely grazed the animal's cheek sufficiently to draw blood.

It was time for us to return, and we left them there. Before going, however, we learned that upon his return home, the man who had first shot the lion would have to go through a special ceremony of purification, and that certain parts of the lion's body (genitals, fat, vertebral bones and their marrow) would be used as ingredients in the next lot of hunting *tshitlhô* that was prepared. And so ended a thoroughly satisfactory day's outing, replete with both magic and adventure.

That was my first contact as an anthropologist with Bushmen, though as a child in Namaqualand I had casually known several working on farms. During the next few years, I was to see much more of them. At one time they were spread over the whole of southern Africa, from the Zambesi River in the north down to the

◂ **Kabush,** like the rest of his people, adores tobacco. His worldly possessions lie in the desert sand

▾ **His pipe** is made out of the shinbone of a buck, but he is using white man's tobacco

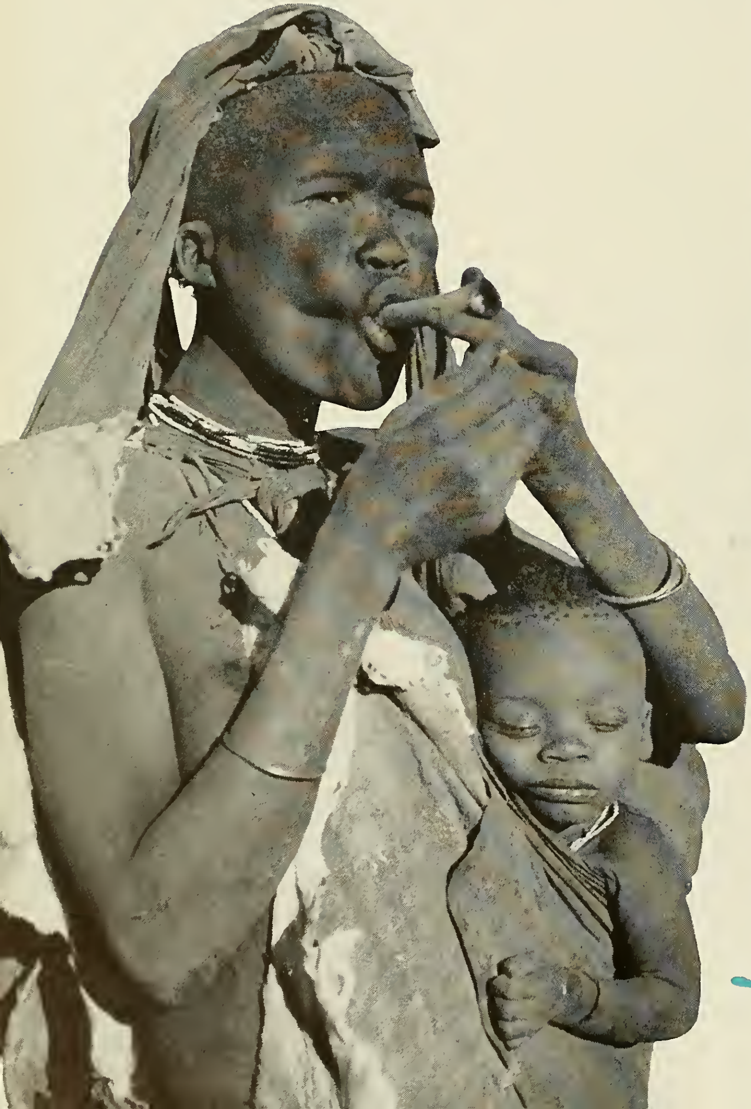
south coast and from the Indian Ocean in the east to the Atlantic in the west. They are now confined mainly to the arid regions of the Kalahari Desert. Their skeletal remains, culture deposits, pictorial art, and place names are found widely scattered elsewhere, in localities from which they themselves have long ago disappeared. Indeed, they are so rarely seen nowadays in the Union of South Africa that the few surviving families were in 1936 gathered together by an enterprising big-game hunter and put on show as a curiosity at the Empire Exhibition in Johannesburg—where one of them astounded me by asking, in perfectly good English, for ice cream!

But they are still fairly numerous in the vast thirstland commonly known as the Kalahari Desert, which extends over the northern and western parts of the Bechuanaland Protectorate and the adjoining districts of South-West Africa. In the Ngwato Reserve alone (the territory of Tshekedi and Seretse), a census officer specially appointed for the purpose spent a year on the task in 1935-6 and personally counted nearly 10,000 of them. In the country as a whole, there are probably at least 30,000.

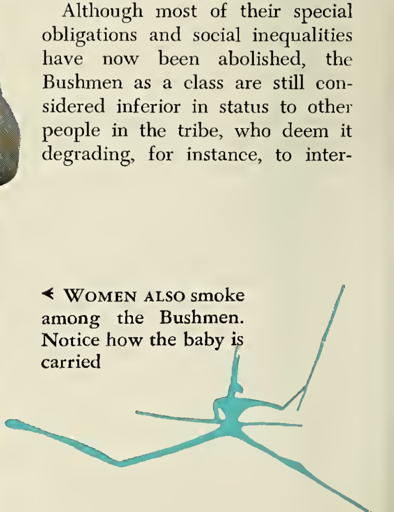
Many of the Kalahari Bushmen were until quite recently the serfs of the Tswana tribes who had moved into their country. It was men of this class who figured so prominently in our lion hunt. They were parceled out, according to the areas in which they lived, among the chiefs and other leading members of the tribes. They were gradually supplied with guns and dogs by their masters, to whom they had to give the ivory, ostrich feathers, furs, and skins of the wild animals they killed, receiving in return small gifts of *dagga* (wild hemp), tobacco, and beads.

Among the Ngwato, the famous Christian chief Kgama (1875-1923) later encouraged his people to teach the Bushmen animal husbandry and agriculture. Their duties were thus extended, until ultimately they hunted, herded cattle, plowed, and did other domestic work. They and their descendants were permanently attached to their master's family unless he gave them to someone else. They had no legal remedy if he ill-treated them, as he often did; and if they tried to run away, they were often followed up and brought back by force.

Although most of their special obligations and social inequalities have now been abolished, the Bushmen as a class are still considered inferior in status to other people in the tribe, who deem it degrading, for instance, to inter-



◂ WOMEN ALSO smoke among the Bushmen. Notice how the baby is carried

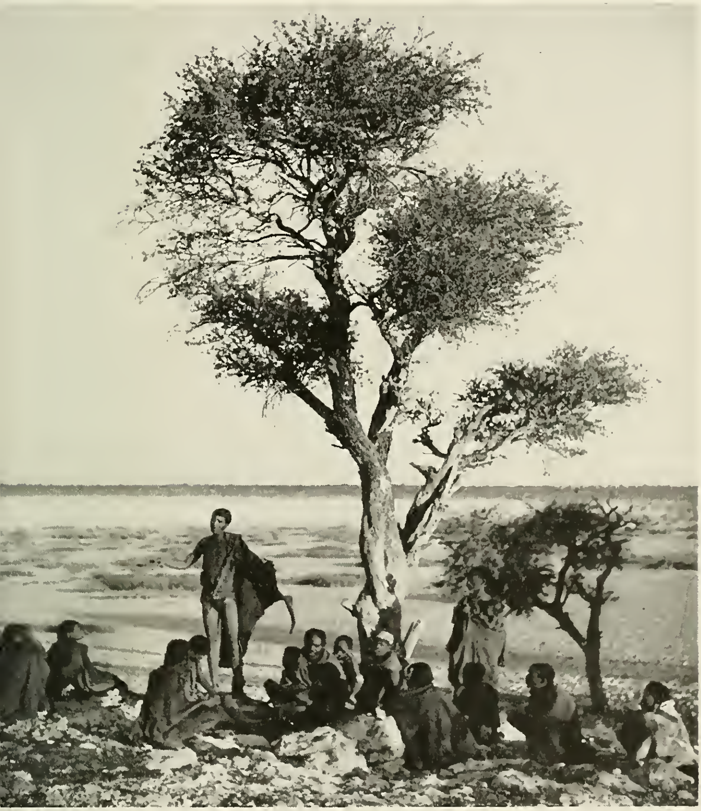


marry with them. But their magicians are treated with much greater respect. They have an unrivaled knowledge of herbal medicines and treatments. They are often employed in cases of serious illness and for other forms of magic, including, as we have seen, the achievement of success in the chase.

There are, however, many other Bushmen who have never been subject to the Tswana and who still lead their traditional mode of life. These so-called "wild" Bushmen derive their subsistence entirely from hunting and collecting. They have no domestic animals other than the dog, and they practice no agriculture. They live mainly on wild plants, such as roots, melons, berries, and nuts, but they also eat almost any form of animal life—except the baboon and the hyena, the former "because it is so like a man," the latter "because it feeds on human corpses." Hunting is the work of the men. Their principal weapons are the bow and small poisoned arrows, but they also use throwing sticks and spears, traps, snares, and pitfalls of various kinds.

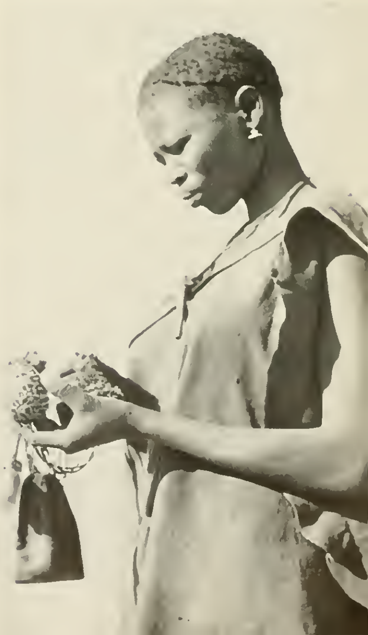
The collecting of vegetable foods is done by the women, who use a pointed digging stick of hard wood. Theirs, too, is the daily task of gathering firewood and fetching water. A buck's stomach makes a handy water bag, and the shells of ostrich eggs are also used for carrying and storing water. In some parts, during the winter months, surface water is very scarce, and the people then obtain liquid nourishment from wild melons (*Citrullus vulgaris*). Elsewhere they use hollow reeds to suck up water through the sand beneath which it lies.

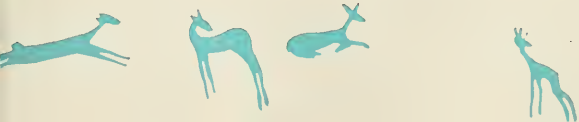
Because of their subsistence activities, all the "wild" Bushmen are wanderers. As soon as the edible plants in the vicinity of one water hole grow scarce, the people move on to another, following the movements of the game and the growth of the plants. They seldom remain at any place for more than a few



⮝ Pausing for a rest. In the background is a salt pan, a deposit formed by an intermittent lake

➤ Even among the Bushmen, there is time for beautification. This young girl carries a tortoise-shell compact, a jackal's tail puff, and a bottle of snuff or tobacco—all in a little bag that she hangs around her neck





weeks. In the dry season, they are confined to localities where water can be found; but when the rains come, they roam about freely within the limits of their territory. Moving about in this way, they have no permanent homes. Their dwellings, erected by the women, are generally crude semicircular shelters of branches planted into the ground and covered with grass. They are easily put together and are lightly abandoned when camp is changed.

Their mode of subsistence also prevents these Bushmen from living together in large numbers. They are scattered about the country in small separate bands, each containing on the average from 50 to 100 persons, all of whom are usually related by blood or marriage. Each band manages its own affairs under the leadership of a hereditary headman, assisted by the older, more experienced men in general. His main tasks are to decide upon and regulate the movements of the band from one place to another, arrange where and how the men are to hunt, and distribute the meat of the animals they kill. He also decides if an enemy band is to be raided and must then himself lead the attack, unless he is too old. But he has no special means of enforcing his will, and he can hardly be described as a ruler.

Disputes between members of the band are not referred either to this headman or anybody else for settlement, nor does he intervene in such cases. A man who has been robbed or assaulted, or whose wife has been unfaithful, or who has been injured in some other way, must proceed directly against the offender and get what satisfaction he can. In case of homicide, similarly, the nearest male relative of the dead person is obliged to seek out and kill the murderer. Together with trespassing, the blood feud is the principal cause of enmity between neighboring bands.

Each band also has its own hunting territory, defined as a rule by such natural features as trees, hills, old river beds, and the like. The members of the band may not hunt or search for food outside their own area. Trespassing on the land of another group is one of the most serious offences in Bushman life. It is always punished severely and may even lead to death. Some adjoining bands, indeed, are in a state of perpetual feud because of such incidents, and, even if in the company of white men, a Bushman having to go beyond his own area will not venture off the main road for fear of his life. But if the bands are friendly, as may also well happen, people go freely enough from one to another to trade, seek a wife, or visit relatives.

Within a band, the only division is into families, consisting of a man and his wife, or wives, with their dependent children. Polygamy is practiced, but not extensively. Generally only a few of the older men have more than one wife. A man may not marry a woman of his own band. In some regions, it is said, wives are acquired by capture, but this only happens if the bands are unfriendly. Elsewhere marriages are usually arranged beforehand; and although the women make a show of resistance and flight, this seems to be little more than a ceremonial gesture. The prospective bridegroom must kill a big game animal for the marriage feast, thus showing that he is capable of supporting a wife. For the first year or so afterward, he lives in her band, hunting for his parents-in-law; but once she has borne him a child, he is free to return with her to his own group.

Children are nursed by their mothers until about three or four years old, owing to lack of suitable food. They are given vegetable mush from a very early age, but to satisfy their hunger they must still have recourse to the breast. This prolonged nursing is responsible for the widespread custom of infanticide. Any child born before its predecessor is weaned is usually buried alive. The women say they cannot provide for two children of different ages, both needing to be carried on marches, and are therefore determined not to have another child to rear until the first is able to live without their milk and care. If twins are born, the weaker of the two, or the male if they are of opposite sexes, is usually also killed at once. Because of these customs, and of the high infant mortality caused by the natural hardships and strenuous conditions of Bushman life, relatively few children survive. It is rare for more than two or three in a family to grow to maturity.

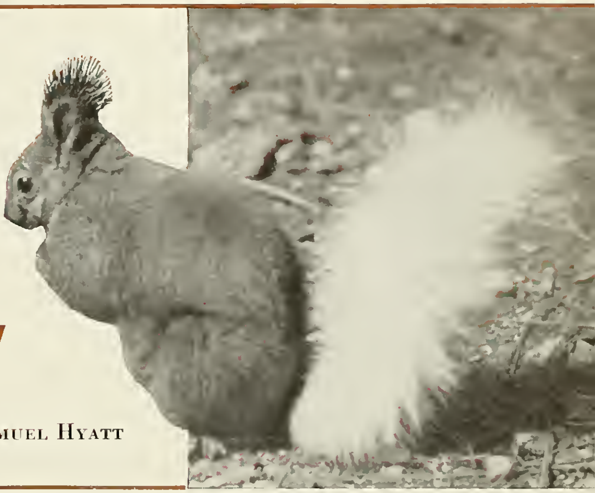
Nor, as a rule, do many Bushmen reach a ripe old age. This is due to another of their customs. When forced, as they sometimes are by drought, to make long hurried treks in search of food, they sometimes have no alternative but to abandon aged people too feeble to keep up with the rest. With loving care, a screen of bushes is erected round the old man or woman, a heap of firewood is put beside him, and he is also left a little food and water if possible. The band, after a ceremonial leave-taking, then pushes on. Should game and water be found within a couple of days, someone is sent hurrying back with supplies; but more often than not the people continue their trek, knowing that the end must have come and that hyenas have dealt with the corpse.

I have singled out these particular customs because they illustrate most vividly how difficult the conditions of life sometimes are for the Bushmen. It is necessity, not inhumanity, that forces them to these extreme measures, and the desperation with which they resist encroachment upon their hunting grounds is another indication that scarcity of food is an ever-present threat. When game has been killed and their bellies are full, they are a merry and convivial people, dancing happily and exuberantly through the night. But such occasions are not very frequent, and the German ethnologist Fritsch was not far wrong when he wrote, in 1872, that "the Bushman is the unfortunate child of the moment."

One of our most distinguished-looking
squirrels can only be seen
in the lofty Kaibab forest
near the Grand Canyon

A Tuft-eared White-tail

By Frieda *and* Samuel Hyatt



ONE of the rarities of this continent is the natural "stock fence" formed by the Grand Canyon and the arid country near Utah. This dead end kept the wild animals in this region from doing any migrating. As a result, the Kaibab Squirrel is found nowhere else in the world except in the Kaibab Forest north of the Grand Canyon.

To get there, turn right off U.S. 66 at Flagstaff, Arizona, and follow U.S. 89 north to Marble Canyon, cross the Navajo Bridge, and go to Jacob Lake. To see the squirrel, look for him early in the morning or in the evening. He most generally snoozes during the middle of the day.

The Kaibab squirrel has a playground of 245,000 acres of Yellow Pine forests. The bark of the year-old Yellow Pine twigs is his favorite diet. For dessert, he eats the inside of the green cones. This is one squirrel who doesn't have to store his food, since the pine twigs are in reach of his paws all the year long. Pine cones, weeds, and mushrooms also appeal to the squirrel's palate.

Tufted ears and a huge feathery tail give the Kaibab squirrel a royal appearance, and he knows it. The upper parts of this inhabitant of the huge Ponderosa Pine trees in the Kaibab National Forest are dark grizzled gray with a rusty red strip down the back. The saucy creature's nose is nearly black, as are his lower sides and the upper parts of his forelegs and thighs. His underparts are mixed black and gray. His eye-catching tail is nearly pure white and very feathery. He makes himself comfy in his nest 40 feet above the ground. This home is about the size of a bushel basket and is made of pine needles, twigs, grasses, bark, or whatever else might be handy in the branches of living trees. When the squirrel is idle, he lets his tail fall over his back. In the winter, this is a perfect camouflage. The young stay in their homes until they are two-thirds grown.

This furry citizen of the forest has a body 12 inches or more long and a tail of the same length. He either goes in for a waddling walk or quick graceful bounds, depending on his mood. Ordinarily the Kaibab doesn't have anything to say, but when he is riled he gives off a number of deep churring calls, emphasized with rapid jerks of his tail. The churring calls are not easily recognized by one who has not heard them. To make it further difficult to detect, the squirrel is expert at hiding from sight among the branches of trees.

Some years ago a couple of Kaibab squirrels were sent to the zoo in Washington, D. C. They did all right at first but in a short time died. Experts figure the humidity did it. The Kaibab loves to frisk through the pines of the Kaibab Forest at altitudes of 7000 to 9000 feet. He ought to be around for a long time, for it is against the law to kill one. Walter G. Mann, Supervisor of the Kaibab National Forest, points out that it is unlawful even to have a Kaibab squirrel skin in your possession—accidentally or otherwise.

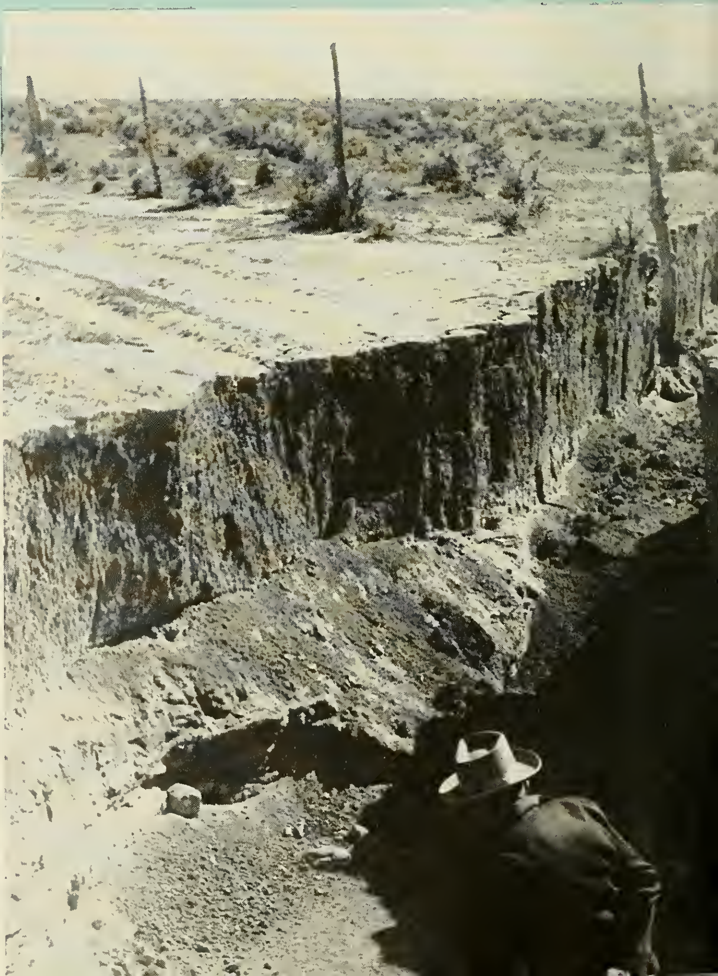
Children and adults alike enjoy watching the unique Kaibab Squirrel at play in its natural habitat. One interesting sight is Mother Kaibab squirrel nipping at the heels of Baby Kaibab squirrel to make it learn to climb trees. The mother keeps nipping her offspring until it negotiates the length of the tree. The antics of this delightful animal can be seen firsthand in the vicinity of Jacob Lake, the public camp at Bright Angel Point in the National Park, or on what the residents call the West Side, specifically in the area of Big Saddle and Pine Flat hunting camps.

the Catlow Valley Crevice

While its people slept, the valley yawned and swallowed a flood

By **EDITH RUTENIC McLEOD**

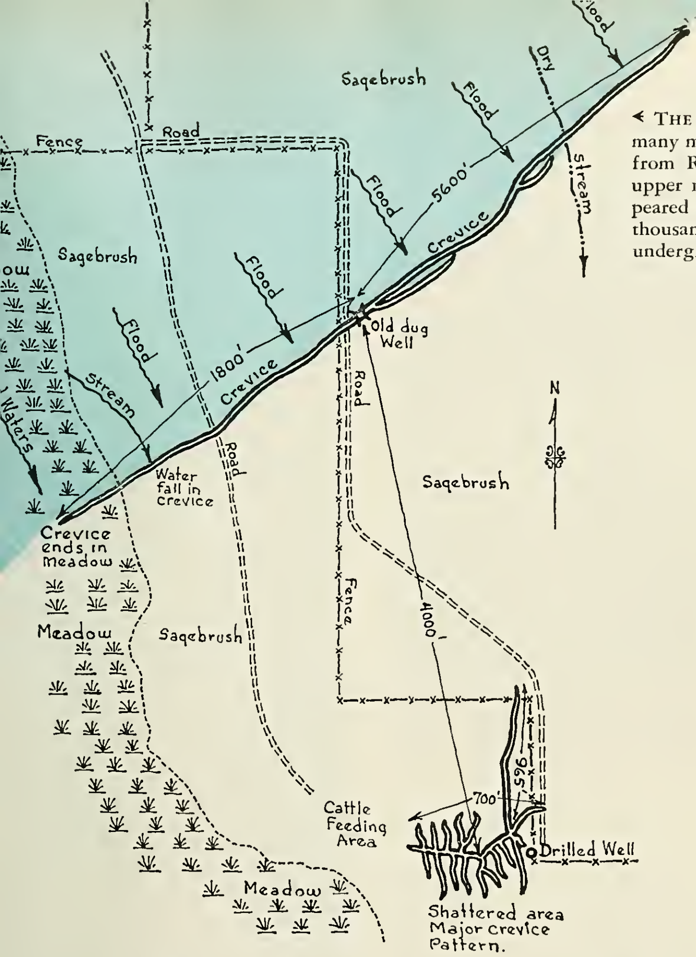
➤ WHERE the crevice cut the road: a view near the center of the 1 1/3-mile crack. Since the earth was not washed out of the crevice, it must have disappeared down the narrow crack at the bottom



A CREVICE 7400 feet long and varying up to 16 feet in width, which appeared on the floor of an isolated valley in Oregon on or before April 14, 1952, has created widespread interest. The crevice is located about a mile southeast of the ranch house on the property of Clarence ("Taft") Miller in Catlow Valley, Harney County. On Rock Creek, about six miles to the northwest, is an earth dam 40 feet high, which impounds water for summer irrigation. On the night of April 14, after the ranch people had retired for the night, Dave McAuliff, a ranch hand who slept downstairs, was awakened by a commotion in the chicken house. He sprang from bed and—stepped into six inches of water!

He knew immediately what had happened.

"The dam's broken," he shouted. "The horses are drowning!" He rushed to the front door. The water


Flood
Dry
Sagebrush
Flood
Fence
Road
Flood
5600'
Stream
Crevice
Sagebrush
Flood
Old dug Well
Flood
1800'
Crevice
Stream
Road
Waters
N
Road
Water fall in crevice
Sagebrush
Crevice ends in meadow
Fence
4000'
Meadow
Sagebrush
965'
700'
Cattle Feeding Area
Drilled Well
Meadow
Shattered area Major crevice Pattern.

◂ THE EVENT occurred in southern Oregon, many miles from a main highway. The waters from Rock Creek Dam flowed in from the upper right-hand side of this map and disappeared into the crevice, apparently carrying thousands of tons of soil into an unknown underground channel

on the outside of the house was two feet deeper than on the inside, and he was nearly swept from his feet by the inrushing flood as he pulled the door open.

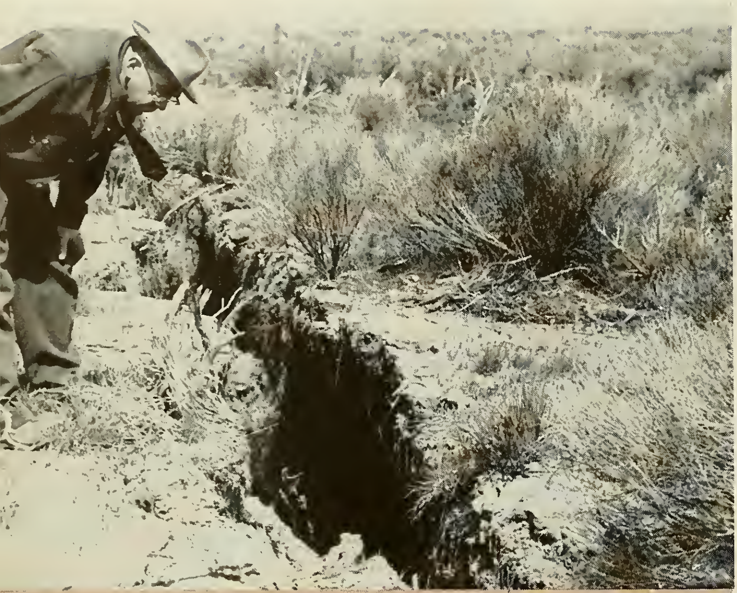
By morning, the water had subsided, but it was April 28 before the ground was dry enough to allow repair work on the dikes broken by the flood. Pete Clairmont, another ranch hand, then started down the road on a tractor, with Miller ahead on horseback. Suddenly Miller stopped. Clairmont could see nothing unusual but heard Miller call, "Look at this!" Approaching, he was astonished to see a crevice sixteen feet wide across the road.

The following Friday, Miller went to Burns on business and reported the phenomenon, which was then made public by Oregon newspapers and radio.

The width of the crevice varies greatly throughout its course. At the widest it is sixteen feet, where an exceptionally large hole has been excavated by flood waters from the broken dam. Much of the crack is around four inches in width.

The sides are vertical in the narrower sections as far down as one can see. In the wider parts, the earth has crumbled back, leaving a straight wall to a depth of about six feet; but from the base of this wall, loose dirt slopes down to the main, deep crack, four to six inches wide. A profile section of the crevice would thus represent a U-shape, six to twelve feet deep, with the narrow, main crack of unknown depth extending down from the bottom of the U. How deep the crevice is, cannot be determined, though one early investigator reported that stones dropped

▾ THE BREAK in Rock Creek Dam, looking upstream. Several thousand acre-feet of water poured through this gap, to vanish mysteriously into the crevice



▲ **Ken McLeod** inspecting the crevice at a narrower place. The earth that disappeared into it is estimated at 12,000 cubic yards

down from one of the wide cracks could not be heard striking bottom.

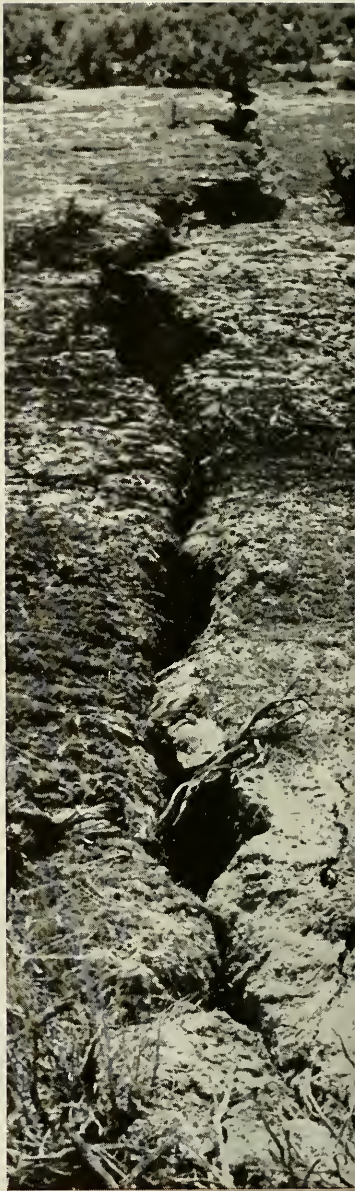
That the crevice was not caused by the type of crustal break known as faulting, is indicated by the absence of vertical displacement of the two walls. Further proof is that a fence that crosses the crevice, as well as two roads and two dry washes, show no disalignment or offset. The wires of the fence show no evidence of noticeable tightening and hence no evidence of observable tension or movement at right angles to the crevice. Furthermore, undisturbed earth caps some portion for short spaces where the fissure is narrow; and where occasional sagebrush clumps straddle the crack, the position of the roots is seemingly undisturbed.

One of the most interesting features is that the crevice neatly disects a well, dug by an early-day homesteader. The well is circular and about four feet wide, with square casing for twelve feet or so below the collar. It is now about 20 feet deep and dry, though local informants say that it was originally 65 feet deep.

That the crack is deep is proved by the fact that the flood waters plunged into its depths and never reached the opposite side of the crevice, except at one place about 40 feet wide. There the water evidently bridged the gap for a short period, probably during the crest of the flood.

The width of the crevice at the surface seems to have been determined by the amount of water that flowed into it from the broken dam. The greater the volume of water, the wider the crevice. We estimated that, along with the water, about 12,000 cubic yards of earth disappeared into the crevice. This would indicate that broken or porous lavas lay below, or perhaps, as one geologist suggests, a former underground channel.

A little less than a mile to the south, we found another series of deep-seated cracks. Their criss-crossing pattern is different, as can be seen on the accompanying map.



Cracks like the above are son
times left by earthquakes, but t
fence post hanging in mid-air
right shows no tension or disalig
ment of the two sides of the dit
In the background is the dry w
mentioned in the text

These cracks vary from one to six inches in width and showed only a little erosion from the water that escaped for a short period from the main crevice.

Since visiting the Catlow Crevice, we have learned that a reservoir at Beatty's Butte, about 20 miles south of the Rock Creek Ranch, lost its water at about the same time. Mr. William Kittridge, owner of the "MC" Ranch, who constructed the reservoir, says that a crack developed in the bottom, draining out all the water. The reservoir was full, and water was spilling over the overflow when the crack opened. In the case of the Rock Creek Dam, on the other hand, the water had not yet reached the spillway. No one lives in the Beatty's Butte section, so it is not known just when the crack opened. But it is believed that it happened at about the same time as the collapse of the Rock Creek Dam and the opening of the main crevice.

In 1937, we found a similar crevice in the southern portion of Catlow Valley, about 25 miles south of the present crevice. The section of the crack that we saw was about 1000 feet in length, averaged 4 to 6 feet in width, and was 4 to 6 feet deep. The deep center crack —presuming there had been one— had been filled by silt from the sidewalls above.

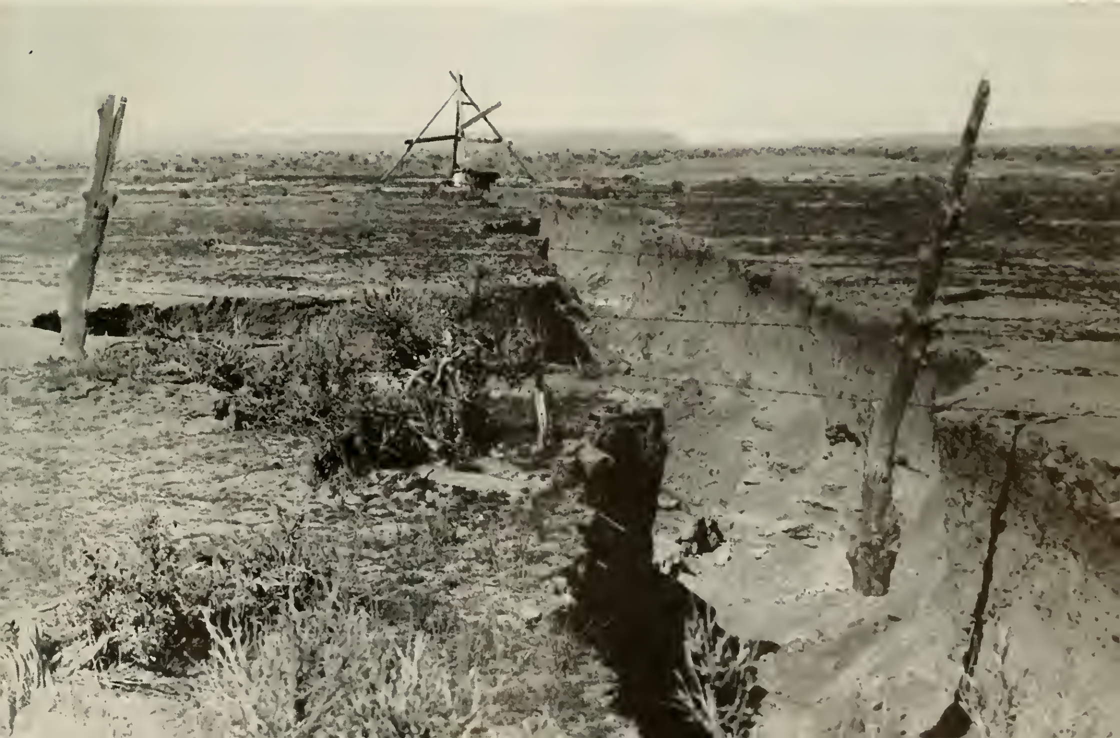
The years of the late 30's were drought years. Ranchers in the region in 1937 complained that there was not enough range feed for their cattle. The present crevice appeared during a wet cycle. And yet, the two crevices are identical in appearance and structure.

Mr. N. S. Wagner, Geologist for the Oregon State Department of Geology and Mineral Industries, made a study of the present crevice. His conclusions, quoted from the June, 1952, issue of the *Ore-Bin,* which he kindly gave me permission to use, are as follows:

"In short, it seems clear that the present surface crevice marks the site of a former underground channel which became saturated beyond capacity and stoped its way to the surface during the period of abnormal conditions [heavier precipitation than usual in that dry region]."

Mr. Wagner thus assumes the existence of a subterranean passageway for the water before the appearance of anything unusual on the surface. It might have been the trace of an earlier fault long since healed over on the surface, he suggests, or it might have been an underground channel reflecting a joint pattern from the underlying lavas. Be that as it may, he considers that there is ample evidence that such a channel existed and that it was enlarged by water action.

Strange things happen to the earth while no one is present to see. This is one of them, and it is the fascination of geology to apply known principles to the explanation of the unexpected. One looks down into that crevice with a somewhat peculiar feeling, wondering what secret its depths conceal. There are still some contradictory elements in the case, and further study of crevices of this sort—not unusual in this semiarid region—might be rewarding.



▲ STARS of "The Blazing Forest" watch the blaze

▲ THE FOREST SERVICE fights the fire. A Paramount picture

▲ JOHN PAYNE in the logging camp

The Screen

Authentic comments on films in the field of nature, geography, and exploration

Edited by ELIZABETH DOWNES

"The Blazing Forest"

"'THE BLAZING FOREST,'" says Richard H. Pough of the American Museum's Department of Conservation, "is a motion picture that should be enjoyed by young people because of the accurate picture it gives of a lumbering operation and the methods currently used in combating forest fires. The various accidents that took place during the lumbering operation seemed entirely credible and added to the drama and suspense.

"In my opinion, however, some of the sequences in the forest fire section were a bit overdone and quite implausible in terms of the ability of the hero to have survived for so long in such close proximity to the flames. I don't suppose there is any harm in this. Such exaggeration is, of course, typical of the motion picture industry, and I must admit it heightens the dramatic effect. The film is certainly good, clean entertainment, which is justification enough for it."

"The Jungle"

"WHEN Hollywood goes to India to shoot a script that features the existence of mammoths in a twentieth century environment, one may logically expect some weird happenings," comments the well-known mammalogist Harold E. Anthony. "If the beholder of this film can lay aside with his wraps, as he takes his seat, any critical sense of plausibility he may have, he may find enjoyment, amusement, and entertainment in 'The Jungle.'

"There are some unusual sequences of animal behavior such as fights between bear and tiger, wild boar and leopard, mongoose and cobra. Also much of the footage on Indian people and topography is of interest and is obviously authentic.

"Nevertheless, the fictional demands of the script impose a pattern that will sometimes make it difficult for the average person to decide what is true and what is false.

"I think it is a fair analysis to say that 'The Jungle' is pure Hollywood seasoned with a sprinkling of natural history and of India."

"Chee-ak"

AN Eskimo movie "Chee-ak," made in 1930 under the title "Igloo," is being re-released in newsreel theaters throughout the country.

"There is some question as to whether this film was intended to be a documentary record of a specific tribe or a composite picture of Eskimo life in general," says Junius Bird, a man familiar with the Arctic from many expeditions. The map at the start indicating Point Barrow, Alaska, as the locale gives the impression of a documentary record. But the story, built around the universal theme of ultimately successful courtship, is so fantastically handled and so far from the reality of Eskimo life in this region either past or present as to put it out of the documentary category. As it is equally impossible to accept it as a composite of Eskimo life in general, we can only conclude that it may portray the average person's conception of Eskimo life.

"That such a film could be made is a tribute to the native actors and an example of their willingness to help on any job, regardless of how foreign to their experience it may be. If the director and producer, Ewing Scott, had only asked and followed their advice, the hunting scenes might have been good and many errors avoided. At the same time, there are some fine shots, such as the dance scenes, which show quite properly that the Eskimos are jolly and quickly forget trouble once past."

▲ HUNTING CAMP scene from "The Jungle." A Lippert production

◀ ESKIMO LOVERS in "Chee-ak"

▼ AN ESKIMO hunting scene

"The greater part of the picture 'Chee-ak' was filmed on the sea ice off Point Hope, Alaska, and not Point Barrow as stated in the introduction," says another reviewer from the American Museum, James Ford. Mr. Ford was present at the very time this film was being made.

"The hero of the picture, Ray Wise, was a handsome half-Eskimo man from Teller, Alaska, who had had a few years of film experience in Hollywood. People from Point Hope village provided the balance of the characters.

"The western Eskimo do not build dome-shaped snow houses. The crude structures supported by whale jaw bones, erected under Scott's direction, could have been improved upon by a well-read troop of Boy Scouts. These houses didn't even have sleeping platforms.

"The scenes of the starvation that led to the southward trek were rather unconvincing. Eskimos often have to expose infants and leave behind the older members of the group, owing to lack of food. But not when there were so many

PREVIOUSLY REVIEWED	WHAT THE EXPERTS SAID
Documentary and Grade A	
The Amazing Monsieur Fabre Life of world-famous naturalist Jean-Henri Fabre	Good insect photography, sometimes erroneously interpreted. Filmed on location in France
Ivory Hunter One man's struggle to build an African Wildlife Park	Authentic geographically. Marvelous shots of big game. Good conservation
Latuko Pattern of life of an African tribe	True picture of life in the southern Sudan. Excellent color photography
Water Birds Disney vignettes from lives of water birds	Superb photography by experts in the nature field and entertaining synchronization of music and bird action
Down the Alphabet	
The Big Sky White traders attempt to open Blackfoot Indian territory, 1832	Blackfoot Indians portrayed with disregard for fact
The Snows of Kilimanjaro Story of a writer with a complicated personality	Some splendid African animal shots. Camp scenes unconvincing
Under the Red Sea An exploratory film with a plot woven in	Rich and varied marine life of Red Sea shown with high photograpic artistry. Narration makes false claims

fat dogs walking around and skins that could be boiled and eaten.

"The migration to the open water to the southward provides some of the most exciting scenes in the picture. There are some excellent shots of dog teams crossing crushing pack ice. Unfortunately, these are interspersed with brief shots of summer ice moving at the edge of the pack as a result of wave action and of people being crushed by plaster of Paris ice in a Hollywood studio. Anyone who has seen Eskimo families on the move with sleds piled high with paraphernalia must congratulate this band on being so well stripped down for the perils of this journey.

"Some of the hunting scenes after open water is reached are also exciting. There is a series of shots that are described as a beluga whale hunt. The first does show a school of white whales, but it is followed by the death throes of a badly-wounded bowhead whale. The enormous spade-shaped head on the whale harpoon looks nothing like an Eskimo whaling harpoon point. The best hunting sequences are those showing walrus."

Your editor feels that the spectator can well judge for himself how much inaccuracies of this sort, once they have been pointed out, may lessen the value and enjoyment of the film. Personally, I felt that I was seeing a truer picture of native life than I do in the average commercial film on the American Indian, who is usually treated as a stock character and a savage. In "Chee-ak," customs very different from our own are presented in a somewhat distorted fashion, but there is no attempt made to pass judgment on them. And I found this refreshing.

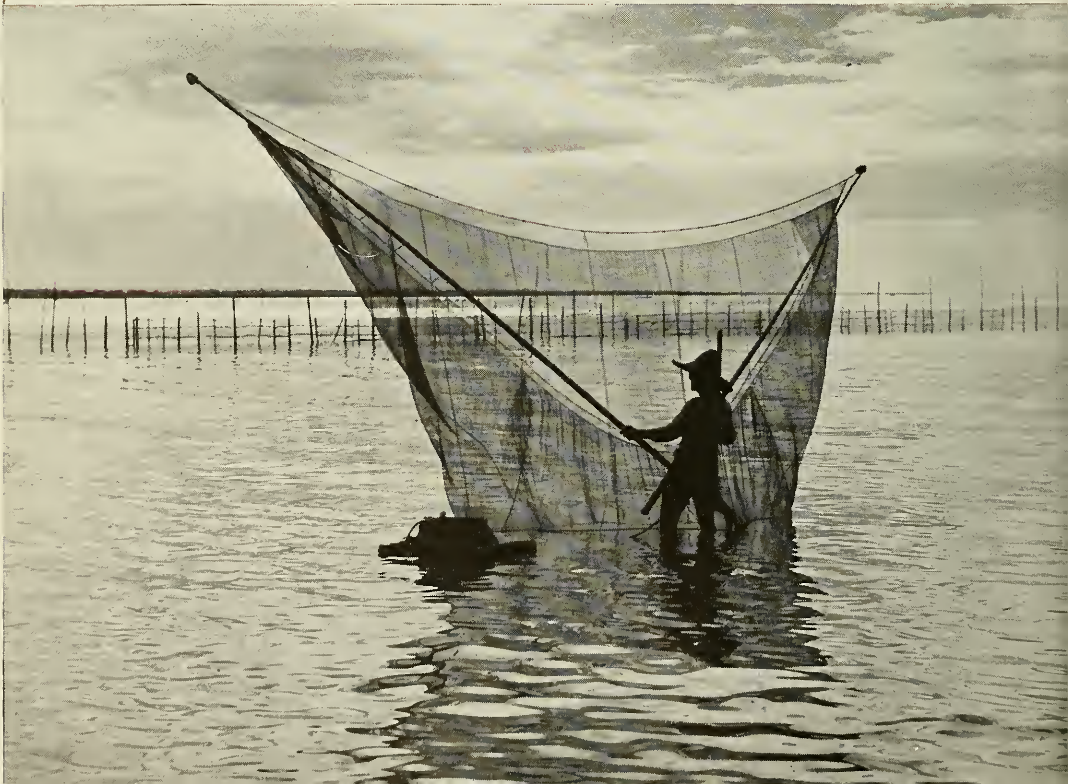
Planes Banned in Wilderness

The legality of an Executive Order prohibiting the flying of airplanes lower than 4000 feet over the roadless area of the Superior National Forest in Northern Minnesota has been upheld by the United States District Court of Minnesota. The roadless area was established by the Secretary of Agriculture in 1929 and is our last large primitive canoe country. It contains lakes and waterways that were once the canoe routes of the Indians and French-Canadian traders. In recent years, the development of privately owned resorts has led to extensive use of airplanes in violation of the original intention. The ban against low-flying planes was applied in January, 1952, to protect the area from encroachment.

Philippine Fisherman

Shrimp fishing at Manila Bay provides interesting views of an activity carried on by lamplight

Photographs by R. M. Milo



AN ARCHITECT IN MAYALAND

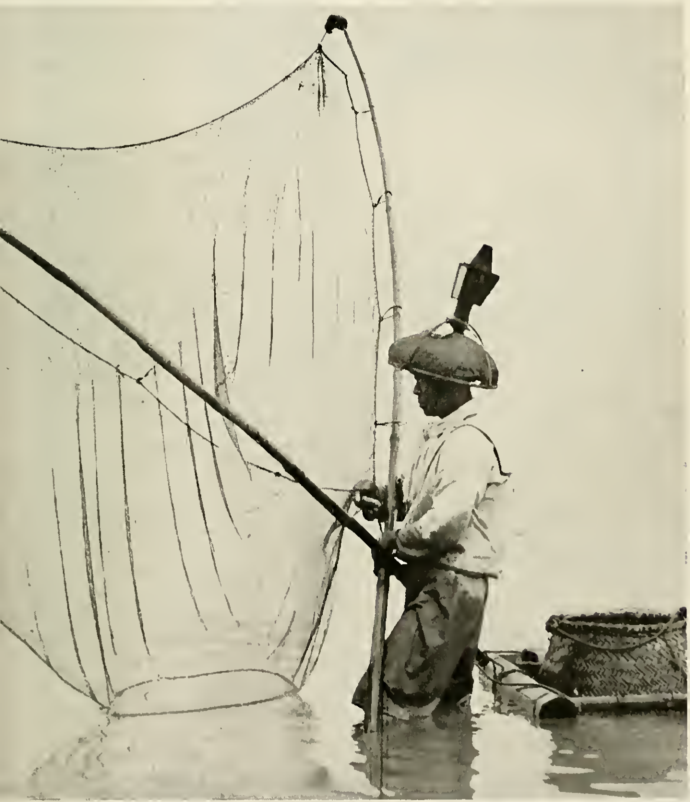
Continued from page 445

discovered by Mr. Anderson, the District Commissioner, whose intense interest in Mayan archaeology has been of great value to expeditions in the area. This particular frieze, bearing a deity mask and astronomical hieroglyphs, was recently excavated by an expedition of the University Museum led by Dr. Linton Satterthwaite. Owing to the fragile nature of the stucco, which was showing signs of disintegration, Dr. Satterthwaite felt that it was of utmost importance that it should be accurately measured and recorded before further deterioration set in and before further excavation of the inner portions of the palace could be undertaken.

Xunan Tunich (literally "The Virgin of the Rock") is a towering site commanding a breath-taking view of the region for miles in every direction. It is located about a mile and a half from the little Indian village of Succotz on the Mopan River some eight miles from Cayo. Arrangements had been made by Mr. Anderson to have a pontoon ferry built of dugout canoes lashed together with empty oil drums so that the jeep could be transported across the river. Since the ferry was not yet complete, I made arrangements to go over by dugout canoes and to walk up the steep hill through the jungle to the ruins. The District Commissioner had already had a wide path cut for the jeep, so the trail was safe for walking, though rather a steep pull in places. Clad in heavy boots, the family wound up the trail every day, each member carrying some portion of the daily supply of water, the medicine kit, and measuring devices. Birds flew along beside us, indignantly scolding and warning the creatures of the jungle of our invasion. Occasionally we saw a snake or a lizard, and we heard many rustlings in the bush. Giant ant hills and ant nests high in the branches of old trees caught our attention.

My chief assistant, Jacinto Cunil, lived in the village of Succotz. He had worked with a number of archaeological expeditions and proved himself to be a quick, intelligent, and indefatigable worker. Although my Spanish was limited to words hastily searched in a pocket dictionary when I began, Jacinto could grasp and follow instructions with uncanny skill. He was an artist with the machete and could construct a ladder, a table, or a sturdy scaffolding without benefit of hammer, nail, or board. I would simply explain by gesture and a word or two what I needed and he was off into the bush, hacking down branches and vines. Under the fascinated gaze of my son Peter, the branches became poles and rungs of a ladder securely tied together with split green vines in a few minutes. Peter became his inseparable companion and was soon a skillful imitator.

To make an accurate drawing of the stucco frieze was no easy task, for the frieze itself was located high on the side of the steep slope of a partially excavated mound. The ornamental bands were at three levels, each set back from the one below. To protect the stucco against weathering, the government had erected a shelter over it, which gave us a certain degree of protection from rain and sun during



HE FISHERMAN examines his net for
ıps and carefully puts them in the
ing basket, which is tied to his waist.
traps can be seen in the background

▲ THE FISHERMAN'S OUTFIT may be simple or more ornate as shown here. The headdress is complete with oil lamp to furnish light during night operations the taking of measurements, but it considerably complicated my work on the upper levels.

My first problem was to establish a device for making accurate meter demarcations horizontally and vertically across the entire frieze. By means of poles lashed in position and strings making a cross-work at exact distances, I was able to proceed with the drawing at exact scale. I was ably assisted in the meticulous measuring and construction of graphs by my wife, Margaret, and my daughters, Jo and Sue, who were my inseparable collaborators during the entire expedition. They helped with many routine tasks such as holding my drawing board in extremely difficult and cramped positions where the use of a tripod was impossible and holding a steel tape in position while intermediate dimensions were marked off. My son Peter, because of his size and agility, was able to hold a plumb bob from locations for which it would otherwise have been necessary to devise a more time-consuming process. Margaret also kept a daily journal.

The entire recording was thus completed in about fifteen days of concentrated effort, and the primary objective of my assignment was accomplished. With these records available to the Museum, they can be studied by Mayan scholars, interpreted, and correlated with other known and new material, even if the actual stucco does not long withstand further ravages of time.

Fortunately, the British Colonial Government is making every effort to preserve the sculpture from vandalism or further deterioration. Both the Governor and the Colonial Secretary are keenly interested in the archaeological findings in the colony. Their enthusiastic interest augurs well for further archaeological work at this and many other known but unexcavated sites.

Time remained for only a rough survey of the entire area included in the pyramid of which this stucco frieze was a portion. While I was drawing the three bands of ornament, Jacinto cleared space on all four sides of the pyramid with his machete. In the course of his clearing he added some excitement by disturbing and killing a deadly fer-de-lance. It now became apparent that the surveying instruments, which had been sent down for my use by the University Museum, would not arrive in time to enable me to locate the four corners of the structure and to relate the exposed frieze to those corners. I therefore sought and obtained the assistance of the Bahamas Exploration Company, whose manager, Mr. W. Ford Young, kindly lent me the services of Mr. Robert W. Krebbs, who was able to give me a very valuable five hours with his plane table.

Meanwhile, work had been proceeding on the ferry despite long delays on account of holiday festivities. Finally, the first trial crossing, witnessed by the assembled villagers, was made and pronounced a success, calling for a round of beer and rum for the District Commissioner, the carpenters, and myself. Thereafter the ascent to the site was made rather more quickly and conveniently than before, though we missed the charm of the quiet walk through the jungle and the serene ride across the river in the silent dugout canoe. Although the ferry was not completed in time to be of substantial assistance in this work, it is serving an anticipated use in transporting visitors to the ruin.

Too soon I had to bring the work to a close, for work at my office had been piling up. We sadly loaded the jeep for the return to Belize. The children were loath to leave sunshine and friends. The District Commissioner's bright young daughter Sylvia and the Hopun children had become their inseparable companions. Swimming in January, rollicking expeditions down the river in a dugout canoe, with the fascination of watching the sluggish prehistoric-looking iguanas creeping along the high branches of the trees at the river's edge, were hard to give up.

The now familiar tinkle of the marimba was audible as we drove away, all of us cherishing the hope that someday we would be coming back to friendly Cayo and delving more deeply into the fascinating secrets of Xunan Tunich.

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